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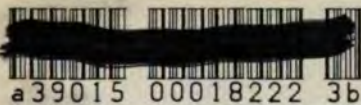
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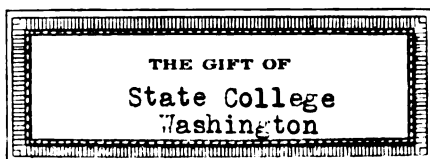
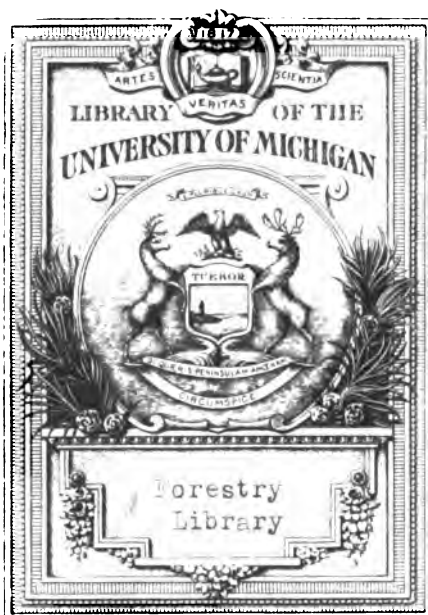
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**FIRST BIENNIAL
—REPORT—**

**THE STATE
FORESTER
OF KENTUCKY**



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GOVERNOR JAMES B. McCREARY
Chairman State Board of Forestry

First Biennial Report

The State Forester of Kentucky

1913

**Published by the direction of the State Board of
Forestry.**

GOVERNOR JAMES B. McCREARY,
Chairman.

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MRS. MASON MAURY,
Louisville.

J. E. BARTON, STATE FORESTER.



THE STATE JOURNAL CO.
FRANKFORT, KY.
1914



ARBOR DAY.

The love of trees is inherent in the human race as is evidenced in their literature, their art and their religious observances. Individual trees, groves and forests have been the object of love and veneration since the beginning of history. So it is small wonder that the Hon. J. Sterling Morton, of Nebraska, when he contemplated the nearly treeless condition of his State, took counsel with himself to remedy this condition and supply some of the beauty and utility which trees furnish, by the general planting of trees throughout his State. He suggested setting aside a day for the special purpose of planting trees and in 1872 the Governor of Nebraska acted upon his suggestion with the result that over a million trees were planted in this one Commonwealth. Other States promptly adopted the idea until today Arbor Day is universally observed. The date for such observance is set by a proclamation of the Governor and depends upon what season of the year is most favorable for successful planting.

Of late years Arbor Day has taken on a richer and deeper significance. On May 15, 1908, the Congress of Governors then in session at Washington, D. C., enunciated in their Declaration of Principles that "the great natural resources (of the United States) supply the material basis upon which our civilization must continue to depend, upon which the perpetuity of the nation itself rests," so that the observance of Arbor Day now emphasizes the great economic need of the preservation and perpetuation of our great natural resources and agencies, including our forests. In Kentucky, Arbor Day and Bird Day are linked together in our thoughts, and as the forests of the State form a great source of material wealth and function for the continued welfare of all the citizens, so the birds in their various activities are a powerful agency to prevent and hold in check many of the evils, which, without birds, cost us thousands of dollars each year to control and exterminate. Arbor Day serves to rivet our minds on these things and to emphasize the necessity of forests, the advisability of conserving those we have and the great desirability of extending our forests over suitable areas which would otherwise be barren wastes.

ARBOR DAY PROCLAMATIONS.

By the Governor.

I, James B. McCreary, Governor of the Commonwealth, do issue this proclamation, designating Wednesday, November thirteenth, nineteen hundred and twelve, as Arbor Day for the Commonwealth of Kentucky, and request its observance by the planting of trees and such other appropriate exercises as may be deemed proper.

The attention of all the people, and especially the teachers and pupils of all the colleges and schools, is called to the importance of planting trees. A priceless heritage has been wasted in Kentucky, and we should try to do our duty by making every proper effort for a renewal of our forests.

Other States are giving much attention to Arbor Day. In one State over one million trees were planted on one Arbor Day, and the benefit derived in other States by planting trees was great. More attention should be given to the proper observance of Arbor Day in Kentucky than has been given heretofore.

Trees planted on the next Arbor Day will add to the beauty of the neighborhood, and to the wealth and welfare of the future and supply the increasing need in many parts of the State.

School house yards, home yards and public roads should be beautified with trees. Our natural forests are diminishing, and we must not only save what is left of the forests, but we must reforest the cut-over, the burnt-over and the unforested districts of the State.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Commonwealth to be hereunto affixed. Done at Frankfort, the fourteenth day of October, in the year of our Lord, one thousand nine hundred and twelve, and in the one hundred and twenty-first year of the Commonwealth.

(Seal.)

JAMES B. McCREARY.

By the Governor.

C. F. Crecelius, Secretary of State.

By W. L. Geiger, Assistant Sec'y of State.

I, James B. McCreary, Governor of the Commonwealth, do issue this Proclamation, designating Thursday, November sixth, 1913, as ARBOR DAY for the Commonwealth of Kentucky, and request its observance by the planting of trees and such other exercises as may be deemed proper.

The attention of all the people, and especially the teachers and pupils of all the colleges and schools, is called to the importance of planting trees. Every proper effort should be made for the renewal of our forests.

In the last decade there has been great development along forestry lines in the United States. The inauguration of forest management in the national forests, the activity of various States in public forestry, and the interest of private owners in tree-growing, have resulted in marked improvement in everything connected with forestry. There are now a number of colleges in the United States where forestry is included in the curriculum. In the last few years there has been a constantly increasing activity in the forestry of the various States, and now thirty States have some kind of organization for forestry work.

I call upon the people to give more attention to the observance of Arbor Day in Kentucky than has been given heretofore. I not only desire the students of all the colleges to take an active interest in the setting out of trees, but the pupils of every common school in the State could render immense service by each of them setting out one tree on Arbor Day.

School house yards, home yards, public roads, pastures and fields should be beautified with trees. Our natural forests are diminishing, and we must not only save what is left of the forests, but we must re-forest the cut-over, the burnt-over and the un-forested districts of the State.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Commonwealth to be hereunto affixed. Done at Frankfort, the fourteenth day of October, in the year of our Lord one thousand nine hundred and thirteen, and in the one hundred and twenty-second year of the Commonwealth.

(Seal of the Commonwealth.) JAMES B. McCREARY.

By the Governor.

C. F. Crecelius, Secretary of State.

By Cecil H. Vansant, Assistant Sec'y of State.

"WELCOME TO CAPITOL AND SIGNIFICANCE OF ARBOR DAY."

Governor James B. McCreary.

(Speech delivered at the Arbor Day exercises and memorial tree planting at the Capitol, Frankfort, Kentucky, November 13, 1912.)

I, with pleasure, extend a hearty welcome to all who have honored us with their presence today.

As Governor of Kentucky, I issued a proclamation designating Wednesday, the thirteenth of November, as Arbor Day, and requested that this day be observed for tree planting, and such other exercises as might be deemed appropriate.

The attention of the people of Kentucky, and especially of the teachers and students at the schools, was especially called by me, and I asked them to take an interest in the planting of trees. Other States have their Arbor Days, and much benefit has been derived therefrom. In one State there were over a million of trees planted in one day—their Arbor Day. More attention should be paid to Arbor Day in Kentucky than has been in the past years. School house yards, home yards, and public roads should be ornamented and beautified with trees.

It is a regrettable fact that in the last twenty years our forests in many places have diminished, and the object of this great movement is to reforest vacant places, burnt out districts and non-forested districts.

When Kentucky was marked out of a wilderness, those who did it were reckless of the timber. But now we have reached the time when the people must not only preserve the timber we now have, but they must promote its growth if we want timber in the future. This Arbor Day has a delightful diversion. We have, today, in addition to the usual exercises, a new and interesting feature on this Arbor Day, in the planting of one tree by each county in Kentucky, on the State Capitol grounds. We are starting a beautiful arboretum here, in the rear of this magnificent Capitol, and by and by, when Kentucky's men and women visit the Capitol, and look upon this beautiful structure, and upon the beautiful mansion that is being erected for the Governors who

succeed me (and I hope to occupy it a while myself), they will feel in touch with all the State, and with their homes, for they will find a tree marked with the county where they live, and this magnificent arboretum will bring us all in touch and sympathy with each other.

Tree planting dates away back into the past. It may be new to the people of Kentucky, but thousands of years ago, in some of the old countries, they had days for tree planting; as in the Fifth Century, in a village in Switzerland, where they had no trees, the good men and women had a meeting, and they said we will have a grove, and decided upon an oak grove, and accordingly, they appointed a committee, and these men went to some trouble, and spent some money, and imported a bag of acorns. I don't know where they came from, they didn't come from Kentucky. They put out the acorns, but they did not grow. The people were determined, and a day was fixed, and they marched to the woods and each dug up a sapling, and carried it to the village where the grove was to be planted. Then with shovels and picks they dug holes in the ground, for they did not have the modern way that we have. We took dynamite and blew out these holes, but they dug in the ground until they had room enough to put these trees out. And now they have in that Swiss Village a beautiful arboretum.

The first movement in behalf of Arbor Day in the United States was made by J. Sterling Morton, a man I knew well in Washington, who was the first Secretary of Agriculture. I had the honor, while in Washington, of introducing the bill establishing the Department of Agriculture, and Mr. J. Sterling Morton was made the first Secretary. When I went to Washington I found there a Secretary of the Treasury, a Secretary of War, a Secretary of the Navy, a Secretary of the Interior; they had a secretary for every branch of government except the greatest branch in the United States, and the greatest in Kentucky, that is agriculture, and I had the honor of introducing the bill authorizing the President to appoint the Secretary of Agriculture, to get in touch with the farmers. That bill was passed, and shortly after Mr. J. Sterling Morton, of Nebraska, was duly appointed the first Secretary of the Department of Agriculture.

He is generally credited with originating tree planting in our country. In 1872, by his request, the Governor of Nebraska issued

a proclamation designating Arbor Day, and asking that the schools and citizens generally observe the day by tree planting. It is said that over one million trees were planted on the first Arbor Day in Nebraska. The cities of Denver, Chicago, St. Paul, Kansas City and others, have adopted the plan of buying trees and donating them annually by the thousands, to persons who agree to plant and water them.

In the last decade, there has been great development along forestry lines. The inauguration of forest management in the national forests, the activity of various States in public forestry, and the interests of private owners in tree growing and protection, have resulted in marked improvement in everything connected with forestry. There are now a number of colleges in the United States where forestry is included in the curriculum. In the last few years there has been a constantly increasing activity in forestry among the various States; and now about thirty States have some kind of organization for forestry work.

The last Legislature passed a bill, which I had the honor to prepare, which authorized me to appoint a Forester for Kentucky. That bill provided that I must appoint a man who was a graduate of some school of forestry, and there could not be found in the whole State of Kentucky a graduated forester, and I had to go to Washington and talk with Mr. Graves, U. S. Forester. I said: "I want a Kentuckian," and you will excuse me if I tell you the rest. I said: "I want a Democrat," and there was one from Kentucky, but he had left the United States service, and had gone into Canada. I want to tell you that I did find a forester, who, thought not born in Kentucky, had worked several years in this State, and like all other men who come in contact with our girls, he married a Kentucky girl. And when I asked him about his politics, he said: "I am a Democrat," and I appointed him. His name is J. E. Barton.

Congress gave marked attention to forestry in a number of forest reservations, in irrigation bills, and in the Appalachian Forest Reserve Bill.

There is in New York, a beautiful, unique and interesting living tree museum, which shows the increasing interest in forestry manifested by the people.

The American Scenic and Historical Preservation Society is now constructing an Arboretum at Letchworth Park, in the State

of New York. It will be a collection of the most valuable timber trees in the world, and it will be the first of its kind ever constructed in any country. Its contribution to the cause of forest conservation in the United States will be of great economic and scientific value.

The National Forests cover a gross area of about one hundred and ninety millions of acres, situated chiefly in the western part of the Republic. The administration and protection of this vast domain constitutes a great task. Altogether, there are one hundred and sixty-two national forests in the United States, averaging over one million acres each, and two thousand four hundred and forty-two men are required to properly attend to the national forests. In a personal interview with the United States Forester at Washington, I was able to arrange for co-operation between the Kentucky Forester and the United States Forester, both in the preservation and increase of our forests, and in the payment of the expense incident thereto.

Forests help to condense the vapor of the sky into clouds and rainfall. They aid in regulating the flow of the water in our streams and rivers, and in lessening the volume and frequency of the floods and freshets which carry off the soil and thereby diminish the fertility of the land. If our water sheds were stripped of the forest coverings which check and regulate the distribution of the rainfall, the resulting floods would be very injurious.

If we love our State, if we love our cities and towns, if we love our homes, we should beautify them and make them attractive and lovely with trees and flowers. It has been well said that men are trees, women are vines, and children are flowers. This is a beautiful illustration, and should be remembered, and men, women and children should do all in their power for our forests. Forestry should be taught in the schools, and should be treated as one of the important economical and public questions; and nothing will give the student a better idea of forestry than for each student annually, to set out one tree. I cannot close my speech today without referring to the valuable assistance given by Mr. H. F. Hillenmeyer, and Mr. H. Garman, of Lexington, Kentucky, in making the arboretum a success. Mr. Hillenmeyer donated twenty-four valuable trees, and he and Mr. Garman have aided very much in the planting of the trees and in laying off the grounds. Mr. J. E. Barton, the State Forester, and Mr. Robt. Terrell, the Commis-

sioner of Public Roads, have also been active and rendered valuable service in all matters connected with Arbor Day.

God, in His wisdom, has furnished everything necessary to beautify the world, and to meet the wants of mankind, if properly attended to, and, therefore, we should do all in our power for the conservation of the soil, the conservation of the water supply, and the conservation of the forests.

FOREST LAW OF KENTUCKY.

CHAPTER 133, ACTS 1912.

An act to establish a State Board of Forestry, prescribing its duties and for conserving the forests and water supply of the State and appropriating money therefor.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

§ 1. That there be, and is hereby established a State Board of Forestry to consist of six members; namely, the Governor of the State, the Director of the Kentucky Experiment Station at Lexington, the Commissioner of Agriculture, who shall be ex-officio members of the said board and three persons to be appointed and commissioned by the Governor, with the advice and consent of the Senate, and to hold office as hereinafter provided.

A State Forester shall be appointed by said board, and he shall be a graduate of a School of Forestry, a technically trained forester and shall have both a practical and theoretical knowledge of forestry and shall hold office for a term of four years and until the appointment and qualification of his successor.

One of the three persons first to be appointed members of said board by the Governor shall be appointed for a term of one year, one for a term of two years and one for a term of three years, and as and when the terms of the members of said board first appointed shall expire, their successors shall be appointed for terms of four years each.

The three members of said board to be appointed by the Governor before entering upon the discharge of their duties, shall each take oath of office prescribed by the Constitution of the State.

§ 2. The members of said State Board of Forestry shall not receive any salary for their services as such, but shall be paid the necessary expenses incurred by them in going to, attending upon and returning from the meetings of said State Board of Forestry, and of its committees. They shall keep an itemized account of their said necessary expenses, which shall be certified and paid in like manner as provided in Section 16 of this act with reference to the other expenditures of the said board.

§ 3. The State Forester, before entering upon the performance of the duties of his office, shall execute bond to the Commonwealth

with surety or sureties worth at the time not less than \$20,000 to be approved by the Governor and filed in the office of the Secretary of State, conditioned for the faithful performance of the duties of his office, upon which; for any breach thereof, action may be instituted from time to time and recovery had to the extent of the damage sustained by the Commonwealth or others. Said bond shall be examined and the sureties approved by the Governor once in each year, and he may at any time when he deems the bond insufficient, require the execution of a new bond or additional sureties on the old one.

§ 4. The care, management and preservation of the Forest Reserves of the State hereafter to be acquired and established, and the forests thereon, as well as future growth thereon, and all moneys appropriated in that behalf, or collected therefrom in any way, and all personal and real property acquired to carry out the objects of this act are hereby made subject to the control of the said State Forestry Board as the same may be herein or in subsequent acts defined and required.

Said board shall observe, keep in view, and, so far as it can, ascertain the best methods of re-forestation cut-over and denuded lands, foresting waste lands, preventing the destruction of forests by fire, the administering of forests on forest principles, the instruction and encouragement of private owners in preserving and growing timbers for commercial and manufacturing purposes, and the general conservation of forest tracts around the headwaters and on the water sheds of all the water courses of the State.

§ 5. Said board shall have the power to purchase lands in the name of the State suitable for forest reserves, at a price which shall not exceed ten dollars per acre, using for such purposes any surplus money not otherwise appropriated which may be standing to the credit of the forest reserve fund; and to make and enforce all rules and regulations governing State reserves, the care and maintenance thereof, the prevention of trespassing thereon, and for the conduct of its officers, agent and employees; and it may accept gifts of land and money to the State for forestry purposes, the same to be held, protected and administered by said board as a State Forest Reserve, and to be used so as to demonstrate the practical utility of timber culture and as a breeding place for game. Such gifts must be absolute except that mineral and mining rights over and under land which may be donated may be reserved by

the donors, and that they may be subject to a stipulation that the lands shall be administered as State Forest Reserves, and the Attorney General of the State is directed to see that all deeds to the State of lands mentioned above are properly executed before the gift is accepted.

§ 6. Before completing the purchase of any land for forestry purposes, the Attorney General of the State shall see to it that a good title thereto is obtained and that the deed or deeds therefor are properly executed before payment is made of the purchase money.

§ 7. It shall be the duty of said board to make or cause to be made a careful investigation of the streams and navigable rivers within and bordering upon the State; of the methods, means, and cost of improving the same; of preventing their pollution; of conserving the water supply thereof; of using the same for the production of power, and how and in what ways the said streams and rivers may be made of most value to the State and to the people thereof.

§ 8. Said board shall preserve all evidence which it may take with reference to conserving the forest and the water supply of the State and the methods best adapted to accomplish those objects and it shall make report of its doings, conclusions, and recommendations to each session of the General Assembly, and, from time to time, publish, in a popular manner, and print for public distribution, in bulletin or other form, such of its conclusions and recommendations as may be of immediate public interest.

§ 9. For the purpose of preserving the living and growing timber and promoting the younger growth on forest reservations, said board, upon the recommendation of the State Forester, may cause to be designated and appraised so much of the dead, matured, or large growth of trees found upon the forest reservations of the State as may be compatible with the utilization of the forests thereon and may sell the same for not less than the appraised value thereof. When the appraised value of the trees to be sold is more than \$1,000, said board, before making sale thereof, shall receive bids therefor after notice by publication once a week for four weeks in two newspapers of general circulation, but said board shall have the right to reject any and all bids and to re-advertise for bids. The proceeds arising from the sale of the timber and trees so sold shall be paid into the State Treasury and

shall be held as a special fund for the purchase of additional lands, and shall be paid out in like manner as money appropriated for the use of said board.

§ 10. The said board acting as a Forestry Commission is hereby empowered to make and execute contracts and leases, in the name of the Commonwealth, for the removal or mining of gas, oil or any valuable minerals that may be found in said forestry reservations whenever it shall be made to appear to said board that it would be for the best interest of the Commonwealth to make such disposition of such gas, oil, or minerals—but before a contract or lease is made the same shall be approved by the Governor of the State and bids therefor shall be received after notice by publication once a week for four weeks in two newspapers of general circulation. The said board shall have the right to reject any or all bids and to re-advertise for bids. The accepted bidder shall give bond with good and sufficient surety to the satisfaction of said board and in such amount as it may fix for the faithful performance on his part of all the conditions and covenants of said contract or lease. The proceeds arising from any such contract or lease shall be paid into the State Treasury to be held and used for the same purposes as the proceeds from the sale of trees and timber and be paid out in like manner.

§ 11. When lands have been acquired by the Commonwealth for forestry purposes, however the same may have been acquired, they shall not thereafter be subject to warrant, survey or patent.

§ 12. The Governor of the State shall be the Chairman of said State Board of Forestry, but when he is absent said board may elect one of its members as Chairman pro tem.

§ 13. The State Board shall keep a full and accurate account of its receipts and expenditures, and it shall make a full and accurate and complete report to each session of the General Assembly, showing in detail, its receipts from all sources and its expenditures and the purposes for which expenditures have been made.

It shall also have power to employ a civil engineer and surveyor from time to time, with his necessary assistants whenever the necessities of the case may require.

§ 14. Subject to the direction of the said State Board of Forestry, the State Forester shall, whenever he may be directed so to do by the said board, co-operate with counties, municipalities,

corporations and individuals in preparing plans for the protection, management and replacement of trees, wood lots, and timber tracts under an agreement that the parties obtaining such assistance shall pay the field and traveling expenses of the men employed in preparing said plans.

§ 15. The State Board of Forestry may establish and maintain a nursery or nurseries for the propagation of forest tree seedlings either upon one or more of the forest reservations of the State or upon such other land as the said board may and which it is hereby empowered to acquire for that purpose. Seedlings from this nursery shall be furnished to the Commonwealth without expense for use upon its forest reservation or other public grounds or parks. Seeds and seedlings may also be distributed to landowners and citizens of this Commonwealth under and subject to such rules and regulations as may be established by said board.

§ 16. The State Forester shall be the Secretary of the board and, as such, he shall certify all expenditures of the board to the chairman thereof who in turn shall certify them to the Governor for his approval, whereupon, he shall authorize the Auditor of Public Accounts to draw his warrant upon the State Treasurer for the amount thereof; and shall have the supervision and direction of all forest interests and of all matters pertaining to forestry within the State; he shall have charge of all forest wardens who may be appointed by said board and the appointment, direction and superintendence of the persons and laborers whom the board may deem it necessary to employ to perform labor in the forest reservations or the nurseries herein provided for; he shall take such action as is authorized by law to prevent and extinguish forest fires; enforce all laws pertaining to forest and wood land; prosecute any violation of such laws; collect information relative to forest destruction and conditions; direct the protection and improvement of all forest reservations; make the investigation required by Section 7 of this act with reference to the streams and navigable rivers within and bordering upon the State and report in writing with regard thereto to the said State Board of Forestry; co-operate with landowners as provided in Section 8 of this act; and, as far as his duties as State Forester will permit, carry on an educational course on Forestry at Farmers' Institute and similar meetings within the State.

He shall also recommend to said board and prepare for its use plans for improving the State system of forest protection, management and replacement and prepare for said board annually, and also whenever required so to do by said board, a report on the progress and conditions of State forest work.

§ 17. The State Forester shall furnish notice, printed in large letters on cloth, calling attention to the dangers of forest fires and to trespass laws and their penalties, and to the rules and regulations of the State Forestry Board, which notices shall be distributed by the State Forester to forest wardens and posted by them in conspicuous places upon State forest reserves and along the highways.

§ 18. The salary of the State Forester shall be fixed by the State Forestry Board and shall not exceed \$2,500.00 per annum and he shall be paid reasonable traveling and field expenses actually incurred in the performance of his official duties.

§ 19. Whenever the State Board of Forestry considers it necessary it may apply to the Governor to commission such persons as it may designate to act as forest wardens of this State, to enforce the forest laws and under the direction of the board to aid in carrying out the purposes of this act, but they shall be subject to removal at any time at the pleasure of the State Board of Forestry. Such wardens shall receive such compensation from time to time as the State Board of Forestry may allow them for special services actually rendered, not exceeding \$2 per day for each day of services. Forest wardens thus appointed shall, before entering upon the duties of their office, take the proper official oath before the clerk of the court of the county in which they reside; after which they shall, while holding said office, possess and exercise all the authority and power held and exercised by constables at common law and under the Statutes of this State, so far as arresting and prosecuting persons for violations of any of the laws or rules and regulations enacted or made or to be enacted or made for the protection of the State Forestry Reserves, or for the protection of the fish and game contained therein, are concerned.

§ 20. It shall be the duty of the forest wardens to enforce all forest laws of this State; to protect the State forest reserves and to see that all rules, regulations and laws are enforced; to report violations of the law to the State Forester; to assist in apprehending and convicting offenders, and to make an annual report to him

as to forest conditions in their immediate neighborhood. When any forest warden shall see or have reported to him a forest fire, it shall be his duty immediately to repair to the scene of the fire and employ such persons and means as in his judgment seem expedient and necessary to extinguish said fire. He shall keep an itemized account of all expenses thus incurred and send such account immediately to the State Forester.

§ 21. The Fiscal Courts or Boards of County Commissioners of the several counties of this State are hereby authorized to levy and appropriate money for purposes of forest protection, improvement and management; and said Fiscal Courts and Board shall have recourse under an action at law for debt against any landowner, individual or corporation on whose account they shall have been obliged to pay out money for fighting fire for the amount which they shall have expended for such purpose.

§ 22. Whoever violates any rule or regulation for the government or use of any State reservation or park, or road, or boulevard traversing the same, shall, for such offense, be punished by a fine of not less than five dollars nor more than fifty dollars, and if the person so fined neglects or refuses to pay the same he shall be committed to the jail of the county there to remain until such fine be paid, but not longer than one day for each and every two dollars of the fine imposed.

§ 23. Any person or persons who shall kindle fires upon any of the forestry reservations of this Commonwealth, except in accordance with such rules and regulations as may be prescribed by the said Board of Forestry, or who shall cut and remove any timber whatever, or who shall do or cause to be done any act that will damage forest lands or timber belonging to the Commonwealth, shall be guilty of a misdemeanor and upon conviction thereof be subject to a penalty not exceeding five hundred dollars (\$500) for each offense committed with costs of suit. If the defendant or defendants neglect or refuse to pay the penalty and costs imposed he or they shall be committed to the jail of the county there to remain until such penalty and costs are paid, but no longer than one day for each and every two dollars of the fine and costs imposed.

§ 24. It shall be unlawful for any persons or corporations, as landowner, to set, or procure another to set fire to any woods, brush, logs, leaves, grass, or clearing upon their own land, unless they shall have previously taken all possible care and precaution

against the spread of such fire to other lands not their own, by previously having cut and piled the same, or carefully cleared around the land which is to be burned, so as to prevent the spread of such fire. The setting of fire contrary to the provisions of this section, or allowing it to escape to the injury of adjoining lands, shall be prima facie proof of wilfulness or neglect, and the land-owner from whose land the fire originated shall be liable in a civil action for damages for the injury resulting from such fire, and also for the cost of fighting and extinguishing the same.

§ 25. Logging and railroad locomotives, donkey or threshing engines, and other engines and boilers, operated in, through or near forest or bush, which do not burn oil as fuel, shall be provided with appliances to prevent as far as may be possible the escape of fire and sparks from the smokestacks thereof and with devices to prevent as far as may be possible the escape of fire from ash pans and fire boxes. Failure to comply with these requirements shall be a misdemeanor, punishable, upon conviction, by a fine of not less than \$10 nor more than \$100 for each and every offense committed.

§ 26. All individuals and corporations causing fires by violation of any of the provisions of this act shall be liable to the State or the county in which the fire occurred for all damages the State or the county may sustain by such fire or fires and in addition thereto to the full amount of all expenses incurred by the State or county in fighting or extinguishing said fire.

§ 27. Justices of the Peace for this State, in the county wherein the offense shall have been committed, shall have the jurisdiction to hear and determine all prosecutions for the purpose of enforcing fines and penalties, collectable under the provisions of this act, not exceeding the amount of \$100, and of holding the offender, under proper bail if necessary, for hearing before the Circuit Court, and committing him to the county jail until such hearing if the required bail is not furnished. It shall be the duty of the Commonwealth and County Attorneys of the several counties and Circuit Court Districts to prosecute all violators of this act.

§ 28. All money received as penalties for violations of the provisions of this act, less the cost of collection and not otherwise provided for, together with any amount obtained from the State Forestry Reserves, shall be paid into the State Treasury to the credit of the forest reserve fund, which fund is hereby created;

and the moneys in said fund are hereby appropriated for purposes of forest protection, management, replacement and extension, under the direction of the State Board of Forestry.

§ 29. The said State Board of Forestry shall have assigned for its use a room in the State Capitol and shall be provided with furniture, stationery and supplies necessary for its use.

§ 30. For the purpose of carrying out the provisions of this act the sum of \$15,000.00 per annum is hereby appropriated out of any money in the Treasury not otherwise appropriated, for the use of the said State Board of Forestry.

§ 31. The State Board of Forestry may expend annually out of the appropriation for its use a sum not exceeding \$3,000 to be used in co-operative work with the Forestry Department of the United States Government under such terms as the said State Board may deem advantageous to the State, provided a like sum is furnished for said purpose by said Government, but the use of this amount or any part of it for this purpose is not obligatory upon the said State Board, unless in its judgment the State will profit thereby.

§ 32. Section 9 of Chapter 90 of the Acts, 1906, and all laws or parts of laws in conflict with this act are, to the extent of such conflict, hereby repealed.

RULES AND REGULATIONS.

I. ORGANIZATION.

A. The activities of the State Board of Forestry shall be divided for convenience into seven branches, to-wit:

1. OperationO
2. LandsL
3. SilvicultureS
4. WaterW
5. GrazingG
6. EducationE
7. AccountsA

B. These several branches of activity shall be designated by their initial and the various phases of activity thereunder are defined and explained as follows:

1. **Operation.** This branch shall deal with all matters of general organization, administration, supervision; employment of assistants, office force, forest wardens, etc.; personnel; improvements; allotments; publications; fire protection, patrol and co-operations; supplies and equipment; and property accountability.

2. **Lands.** This branch shall deal with all matters in connection with the purchase of lands; survey and designation of boundaries; leases or contracts for the removal or mining of gas, oil, or valuable minerals; compilation and publication of maps (except for sales of timber), special occupancy or rental of lands; claims, rights, or interior holdings; administrative, nursery or experimental sites; forest legislation; occupancy trespass.

3. **Silviculture.** This branch shall deal with all matters concerning timber sales (including the estimation of the timber, reports and maps thereon, advertisement, etc.), administrative use of timber; brush disposal; Federal, State and private co-operation; free use of timber; cost and stumpage data; fire and timber trespass; marking of timber; reconnaissance of timber; and timber settlement, nurseries, seed, planting, herbariums, silvics, studies, mensuration and working plans.

4. **Water.** This branch shall deal with all matters relating to water; waterflow; surface run-off; stream measurements; development of water power and occupancy of land therefor; pollution of streams, protection of village and municipal water supplies.

5. **Grazing.** This branch shall deal with all matters pertaining to grazing permits; grazing studies; grazing trespass; grazing supervision; game preservation, breeding, protection and distribution.

6. **Education.** This branch shall deal with all matters pertaining to addresses, lectures, publications, demonstrations, or exhibits for educational purposes.

7. **Accounts.** This branch shall deal with all matters pertaining to appropriations, allotments, gifts, funds, or receipts, however accumulated; expenditures of every description provided for by law under the direction of the State Board of Forestry; appointments, separations, furloughs, dismissals, leaves of absence, financial statements or reports.

A. Operations.

Reg. O-1. The State Forester with the advice and consent of the State Board of Forestry may employ an assistant, a stenographer and such other office force as may hereafter become necessary.

Filing System.

Reg. O-2. A complete filing system shall be devised and maintained in the office of the State Forester for the proper record of all transactions of the State Board of Forestry and the office of the State Forester.

Property Accountability.

Reg. O-3. The State Forester shall maintain in his office a complete list of all instruments, equipment and property which shall hereafter be acquired by the State Board of Forestry in connection with the work of the State Forester.

Field Force On State Forest Reserves.

Reg. O-4. Upon the acquirement of lands by the State for State forest reserves the State Forester shall with the advice and consent of the State Board of Forestry organize and employ the necessary force for the administration of such forest reserves.

Contracts and Deeds.

Reg. O-5. All contracts, deeds of gift or purchase and papers relating to the appropriation of lands, and abstracts of title to

said land shall be approved by the Attorney General, and such a certificate of such approval shall accompany such papers, or be endorsed thereon; and all such original contracts, deeds of gift or purchase, and papers constituting the record of appropriation shall be filed in a depository to be designated by the State Board of Forestry. Copies of all such papers herein enumerated shall be kept on record in the State Forester's files.

Improvements.

Reg. O-6. The State Forester shall, when so directed by the State Board of Forestry cause such improvements to be built and constructed on State forest reserves and nurseries as may from time to time appear necessary.

Fire Protection.

Reg. O-7. The State Forester shall as rapidly as possible investigate and report upon the forest fire conditions of the State and in accordance with his investigations shall, when so directed by the State Board of Forestry, organize the necessary protective force in such regions as may appear necessary.

Reg. O-8. The State Forester shall ascertain as far as possible, the extent and damage of all fires within the State and particularly on the State forest reserves, and shall maintain a record thereof which shall show, so far as can be ascertained, the date, cause, extent, damage, cost and other information of value with regard to such fire or fires.

Reg. O-9. The State Forester shall take such action and perfect such organization as will insure the compliance of persons and corporations with that portion of the act herewith quoted:

"§ 24. It shall be unlawful for any persons or corporation, as land owner, to set, or procure another to set fire to any woods, brush, logs, leaves, grass, or clearing upon their own land, unless they shall have previously taken all possible care and precaution against the spread of such fire to other lands not their own, by previously having cut and piled the same, or carefully cleared around the land which is to be burned, so as to prevent the spread of such fire. The setting of fire contrary to the provisions of this section, or allowing it to escape to the injury of adjoining lands, shall be prima facie proof of wilfulness or neglect, and the land owner from whose land the fire originated shall be liable in a civil

action for damages for the injury resulting from such fire, and also for the cost of fighting and extinguishing the same.

“§ 25. Logging and railroad locomotives, donkey or threshing engines, and other engines and boilers, operated in, through or near forest or bush, which do not burn oil as fuel, shall be provided with appliances to prevent as far as may be possible the escape of fire and sparks from the smokestacks thereof and with devices to prevent as far as may be possible the escape of fire from ash pans and fire boxes. Failure to comply with these requirements shall be a misdemeanor, punishable, upon conviction, by a fine of not less than \$10 nor more than \$100 for each and every offense committed.”

Reg. O-10. The State Forester, with the approval of the State Board of Forestry, shall, if the exigencies of the situation demand, designate certain seasons within which no fires may be set by persons or corporations, or in accordance with the instruction or directions of such persons or corporations, for purposes of clearing land or burning debris resulting from logging or lumbering operations.

Reg. O-11. The State Forester may require such inspection of logging and railroad locomotives, donkey or threshing engines as will insure their being equipped with the proper spark arresters and devices against the escape of fire from ash pans and fire boxes.

Reg. O-12. The State Forester shall furnish all possible assistance to the proper authorities looking to the prosecution of all cases of violations of any provisions of the Acts and the rules and regulations of the State Board of Forestry with regard to fire protection, and shall estimate or cause to be estimated the value of all damage sustained by the State or county within which the fire or fires occurred.

Meetings of the State Board of Forestry.

Reg. O-13. It shall require a vote of four members of the State Board of Forestry at any meeting to amend the rules and regulations of the said board.

Reg. O-14. A meeting of the State Board of Forestry shall be held quarterly, as nearly as possible on the fifteenth of January, April, July and October, as the circumstances warrant: Provided, that the chairman of the State Board of Forestry may call special meetings of said board when important and urgent matters demand attention.

Reg. O-15. At the quarterly meetings of the State Board of Forestry the State Forester shall submit a brief resume of the work of his office during the period just past.

Reg. O-16. The order of business of the State Board of Forestry shall be as follows:

1. Call to order.
2. Calling of the roll.
3. Swearing in of new members.
4. Reading of minutes of previous meeting.
5. Approval of minutes of previous meeting.
6. Report of Standing Committees.
7. Report of Special Committees.
8. Report of the Secretary.
9. Unfinished business.
10. Communications.
11. New business.
12. Adjournment.

B. LANDS.

Purchase of Lands.

Reg. L-1. The Act of the General Assembly approved by the Governor, March 19, 1912, provides (Sec. 5, 6, Chap. 133, pp. 531-2, Acts, 1912), that the State Forest Board shall have the power to purchase lands in the name of the State for forest reserves and accept gifts of land or money to the State for forestry purposes. Land purchased in this manner and for these purposes shall not exceed ten dollars per acre.

Reg. L-2. When it shall come to the attention of the State Forester that certain tracts of land are available for forest reserve purposes, he shall himself examine such land or cause an examination to be made. The examination shall determine the suitability of the particular tract involved for forest reserve purposes and the availability and suitability of adjacent lands for like purposes. The result of the examination shall be embodied in the form of a written report, accompanied by a map which shall be submitted to the State Board of Forestry for their consideration. No lands above the value of \$100 shall be purchased unless personally inspected by the State Forester and at least two members of the State Board of Forestry.

Reg. L-3. When land is purchased by the State Board of Forestry for forestry purposes, the State Forester shall thereupon cause an accurate survey of the boundaries of such tract to be made, the boundaries properly marked, and a detailed map compiled for the area as a basis of future administration and development.

Special Use Regulations.

Reg. L-4. All uses of the State forest reserves, except those specifically provided for in regulations governing water, timber sales, timber settlements and grazing will be designated "special uses." Applications for "special uses" shall be made to the State Forester in writing, who may grant permits for such uses when they are not clearly inconsistent with the purposes for which the forest reserves were created subject, however, to the subsequent approval or disapproval of the State Board of Forestry, to whom all such permits shall be reported at the meeting of said board immediately following the granting of a permit. A record of all permits granted by the State Forester for "special uses" shall be kept by him in his office.

Reg. L-5. The occupancy and use of the State forest reserve land and resources under a special use permit, shall be conditioned upon payment of a charge, which shall be based upon schedules published from time to time by the State Forester with the advice and consent of the State Board of Forestry.

Reg. L-6. In serious emergencies for the protection of life or property forest reserve material may be taken without previous permit, provided a permit for the material so used and the special use so involved is subsequently secured at the earliest opportunity.

Reg. L-7. The State Forester may, in his discretion, issue permits to any road district, county or person, or corporation for the free use of timber, stone, and other forest reserve products for the construction or maintenance of roads or trails within State forest reserves. When the public benefit does not justify such free use the permittee must pay for all merchantable timber cut or destroyed by lands occupied under permit.

Reg. L-8. Wagon roads over State forest reserve lands may be constructed, changed, widened or repaired subject to the approval of the State Forester.

Occupancy Trespass.

Reg. L-9. The following acts are prohibited:

A. Squatting upon forest reserve land, or making settlement thereon.

B. Constructing or maintaining any kind of works, structure, fence or inclosure; conducting any kind of business enterprise, or carrying on any kind of work on State forest land without permit, except as otherwise allowed by law or regulation.

C. The wilful tearing down or defacing any notice of the State Board of Forestry posted within a State forest reserve.

D. Camping within State forest reserves.

E. The posting of advertising signs, bills, posters, placards or advertisements of any description.

Settlement of Trespass.

Reg. L-10. The State Forester is authorized to settle all cases of innocent or unintentional civil trespasses when the value of the forest products taken or destroyed is not in excess of \$100.

Reg. L-11. Settlement of all innocent or unintentional trespass when the total value of the forest products injured, taken or destroyed is in excess of \$100 will be effected by the State Board of Forestry. All wilful civil trespasses, or those involving injury to the lands within the State forest reserves, apart from injury or destruction of forest products, and all criminal trespasses will be reported to the State Board of Forestry for reference to the Attorney General of the State for action.

C. SILVICULTURE.**Timber Sales.**

Reg. S-1. No timebr shall be designated for cutting by stamping or otherwise until the State Forester is satisfied that the cutting will preserve the living and growing timber, promote the younger growth, and be compatible with the utilization of the forest. Upon application for the purchase of timber or where timber is to be sold in advance of application, such timber shall be examined and appraised, and the area from which the timber is to be cut described by legal subdivisions, metes and bounds, or otherwise. The individual making the examination shall report the quantity and value of the various kinds of timber involved, and

shall base his appraisal on the character of the timber, the cost of logging, transportation and manufacture, and the sale value of manufactured products at practicable markets. No sale of timber exceeding \$100 in value shall be binding unless approved by the State Board of Forestry.

Reg. S-2. No timber shall be cut under any timber sale contract before it has been paid for. Refunds may be made in the discretion of the State Forester or the State Board of Forestry to depositors of such sums deposited by them to secure the purchase price of forest products as may be found in excess of the amounts actually due the State. Refunds or payments may also be made of such sums as may be found to have been erroneously collected for timber or other forest products sold from lands within, but not a part of, a State forest reserve.

Reg. S-3. In any sale, the timber may be paid for in one or more payments, as agreed. In sales of \$100 or less the partial payments must not exceed two.

Reg. S-4. Modifications of contracts for the sale of timber will not be allowed except in those cases where the full performance of the contract by the purchaser is rendered inequitable and unjust by some act of the State. Modifications where proper, within the meaning of this regulation, may be made by the State Forester, when approved by the State Board of Forestry.

Reg. S-5. No timber will be sold in amounts exceeding \$1,000 stumpage value in advance of advertisement. When necessary to protect the State against loss, a bond may be required.

Reg. S-6. After any timber has been advertised and no satisfactory bids received, or if the bidder fails to complete the purchase, the State Forester may dispose of the timber at a private sale in quantities to suit purchasers, without further advertisement, at prices not lower than those named in the advertisement. Timber may also be disposed of at private sale without advertisement, where the stumpage value of the timber does not exceed \$1,000.

Reg. S-7. In awarding advertised timber of a value exceeding \$5,000, allotments at the highest prices offered may be made to several bidders to prevent monopoly.

Reg. S-8. No trees on State forest reserves shall be cut except under permit or contract. No living trees shall be cut under any

contract until marked or otherwise designated by the State Forester or his representative.

No timber cut under any contract shall be removed from the place selected for scaling, measurement, or counting until it has been scaled, measured, or counted and stamped by the State Forester or his representative on the ground. No person except the State Forester or his representative shall stamp any timber belonging to the State with the regulation marking ax, hatchet or hammer, or with any instrument having a similar design. All saw timber will be scaled by the Scribner Decimal C log rule, as used by the United States Forest Service.

Reg. S-9. The period allowed for the removal of timber, which shall in no instance exceed four years, except in special cases upon specific approval of the State Board of Forestry, will be fixed in the agreement, and in sales in which a period of two or more years is allowed for the removal of the timber, the minimum amount to be removed each year must be specified, except in unusual cases. The State Forester may, with the consent and approval of the State Board of Forestry, extend the time beyond a period of four years; but such extension will be granted only to prevent hardship in cases where failure to remove the timber within the four-year period is due to circumstances over which the purchaser had no control.

Reg. S-10. The State Forester may in any timber sale require the purchaser to furnish a bond for the satisfactory completion of the contract.

Reg. S-11. The disapproval of an application for the purchase of timber and for the modification of a contract by the State Forester shall be considered final, but the party affected thereby may, by written notice filed with the State Forester within fifteen days from his decision, ask the State Board of Forestry, at its next ensuing meeting, for a reconsideration of the determination or finding of the State Forester, and, in that event, the decision of the State Board of Forestry shall be final.

Reg. S-12. The use of steam engines, donkeys, and locomotives in operation on any State forest reserve land under any timber sale contract or under any permit is prohibited, unless they are equipped with such spark-arresters as are approved by the State Forester, or unless oil is used as fuel.

Administrative Use of Timber.

Reg. S-13. The State Forester with the advice and consent of the State Board of Forestry may, within the amount which said State Board is authorized to sell without advertisement, dispose of under free use, permit or otherwise any timber upon the State forest reserves when such removal is actually necessary to protect the forests from ravages or destruction, or when the use or removal of timber is necessary in the construction of roads, trails, cabins, and other improvements on the State forest reserves or in experiments conducted by the State.

Timber Settlement.

Reg. S-14. When timber on State forest reserve land is cut, damaged, killed, or destroyed in connection with the enjoyment of a right-of-way or other special use, payment therefor may be required at such rate or rates as may be fixed by the State Forester, under the timber sale regulations to sell the amount involved.

Fire Trespass.

Reg. S-15. The following acts are prohibited on lands of the State within State forest reserves:

A. Setting or causing to be set on fire any timber, brush, or grass: Provided, however, that this regulation shall not be construed to prohibit the building of necessary camp fires or other fires for domestic or manufacturing purposes when permit is granted for same by the State Forester.

B. Building a camp fire in leaves, rotten wood, or other places where it is likely to spread, or against large or hollow logs, or stumps, where it is difficult to extinguish it completely.

Reg. S-16. The following acts on any lands within the State are prohibited:

A. Setting or procuring another to set fire to any woods, brush, logs, leaves, grass or clearing upon their own land by any persons or corporations, unless they shall have previously taken all possible care and precaution against the spread of such fire to other lands not their own, by previously having cut and piled the same or carefully cleared around the land which is to be burned, so as to prevent the spread of such fire.

B. Building a camp fire in leaves, rotten wood, or other places where it is likely to spread, or against large or hollow logs or stumps, where it is difficult to extinguish it completely.

C. Leaving a camp fire without completely extinguishing it, when permit has been granted for same.

Timber Trespass.

Reg. S-18. The following acts are prohibited on State lands within State forest reserves:

A. The cutting, killing, destroying, girdling, shipping, chopping, boxing, injuring or otherwise damaging, or the removal of any timber or young tree growth except as authorized by law and the regulations of the State Board of Forestry.

B. The damaging or cutting, under any contract of sale or permit of any living tree until it is marked or otherwise designated for cutting by the State Forester or his authorized agent.

C. The removal from the place designated for scaling, measuring, or counting of any timber cut under contract of sale or permit until scaled, measured or counted and stamped by the State Forester or his authorized agent.

D. The stamping, except by the State Forester or his authorized agent, of any timber belonging to the State with the regulation marking tools or with any instrument having a similar design: Provided, that timber lawfully cut from land which is subsequently included within a State forest reserve may be removed within a reasonable time after the inclusion of such land in a State forest reserve: Provided, further, that the term "timber" as used in this regulation shall be deemed and taken to mean trees of a character or sort that may be used in any kind of manufacture or the construction of any article, or for fuel.

Nurseries.

Reg. S-19. Upon the designation and establishment of a nursery by the State Forester with the approval of the State Board of Forestry, the State Forester may, with the approval of the State Board of Forestry, hire such nursery assistance and labor, purchase such necessary material and supplies as will insure the proper establishment, care and maintenance of such nursery and insure the end for which the nursery was established.

D. WATER.

Reg. W-1. The State Forester may cause such examinations to be made as will insure accurate data in regard to the amount and character of stream flow of the navigable rivers within and bordering on the State; establish gauging stations, designate observers, voluntary or otherwise; institute investigations of the means, methods and cost of improving the streams and regulation of flow, conserving the water thereof and preventing its pollution. He shall also assemble accurate data in regard to the availability of streams and rivers for water power purposes and the value of such power to the people of the State.

E. GRAZING.

Reg. G-1. Grazing of cattle, sheep, goats or hogs upon any State forest reserve will not be allowed except under permit by the State Forester.

Reg. G-2. If upon any State forest reserve, it appears upon investigation that the reserve as a whole or any portion of the reserve will not be injured by the grazing of cattle, sheep, goats or hogs, such forest reserve or portion thereof may be opened to grazing by the State Board of Forestry and the State Forester authorized to issue permits for such grazing. The State Forester shall, subject to the approval of the State Board of Forestry, then establish seasons within which grazing will be permitted and establish equitable charges for grazing privileges.

Reg. G-3. All grazing fees are payable in advance. When an applicant for a grazing permit is notified by the State Forester that his application has been approved, he will remit the amount due for grazing fees to the State Forester to be placed to the credit of the forest reserve fund, and upon receipt of payment a permit will be issued allowing the stock to enter the forest reserve and remain during the period specified. Persons who fail to pay the grazing fee before the beginning of the grazing period must notify the State Forester before the beginning of the grazing period and give satisfactory reasons, or they may be denied a grazing permit the following season within the discretion of the State Forester.

Reg. G-4. Grazing fees will not be refunded for non-use of State forest reserve land except when, in the opinion of the State Forester, the applicant is prevented from using the said lands by circumstances over which he has no control.

Damage to Roads, Trails, or Springs.

Reg. G-5. Each person or group of persons granted grazing permits must repair all damage to roads or trails caused by the presence of their stock in any portion of a State forest reserve.

Disposition of Carcasses.

Reg. G-6. The carcasses of all animals which die on the State forest reserve from contagious or infectious diseases must be burned and the carcasses of all animals which die in close vicinity of water must be removed immediately, and buried or burned.

Salting Stock.

Reg. G-7. Whenever the State Forester requires it, all stock grazed under permit must be salted regularly at such places and in such manner as he may designate.

Quarantine and Local Laws.

Reg. G-8. All stock which is grazed under permit in, or allowed to cross, any State forest reserve will be required to conform to the quarantine regulations of the State Live Stock Sanitary Board, and all live stock laws of the State.

Protection of Game, Fish and Birds.

Reg. G-9. The State Forester will co-operate with the State Fish and Game Commission to enforce the laws of the State for the protection of birds, fish and game. In State forest reserves, which are utilized for breeding places for game and game refuges, all forest officers will act without additional pay as deputy game wardens with full power to enforce the State fish and game laws

Grazing Trespass.

Reg. G-10. The following acts are prohibited:

A. The grazing upon or driving across any State forest reserve without permit, except such stock as are specifically exempted from permit by the regulation of the State Board of Forestry, or the grazing upon or driving across any State forest reserve of any live stock in violation of the terms of a permit.

B. The grazing of stock upon State forest reserve land within an area closed to the grazing of that class of stock.

C. The grazing of stock upon an area withdrawn from use for grazing purposes to protect it from damage by reason of the

presence of the stock or improper handling thereof, after receipt of notice from the State Forester of such withdrawal and of the amendment of the grazing permit.

F. EDUCATION.

Reg. E-1. It shall be the duty of the State Forester to propagate among the people of the State and especially the children a knowledge of the economical and aesthetic value of trees and forests by lectures, talks, publications, bulletins, short sketches and in every other way compatible with the importance of the work.

Reg. E-2. As rapidly as possible the State Forester shall accumulate a library dealing with forestry in all its phases and other closely related branches and subjects. This library shall be situated in the office of the State Forester and shall be available to all persons of the State as a reference library under such rules and regulations as the State Board of Forestry may hereafter approve. Gifts of books, pamphlets, bulletins, etc., may be accepted by the State Forester for the forest library.

Reg. E-3. A record of all speeches, lectures, talks and addresses made by the State Forester or under the auspices or direction of his office shall be kept and copies of such speeches, lectures, talks or addresses kept on file when obtainable.

Reg. E-4. The State Forester shall initiate studies of forest products, their uses, and problems with relation thereto. He may also undertake experiments and investigations with relation to wood composition, wood distillation, by-products and wood utilization generally.

G. ACCOUNTS.

Reg. A-1. A complete system of accounts of all receipts and expenditures of the State Board of Forestry shall be kept in the State Forester's office, and a statement thereof shall be submitted to the State Board of Forestry by the State Forester once every six months and at such other times as the board may request. A full and complete statement of all receipts and expenditures will be submitted to the General Assembly at each session.

Reg. A-2. Copies of all vouchers submitted for payment by the State Board of Forestry shall be kept on file in the office of the State Forester.

REPORT OF STATE FORESTER.

INTRODUCTION.

At the regular session of the General Assembly of the Commonwealth of Kentucky, which began January 2, 1912, and ended March 12, 1912, an act was passed "to establish a State Board of Forestry, prescribing its duties and for conserving the forests and water supply of the State and appropriating money therefor" (H. B. 61. Price, Chap. 133, p. 529, Acts of Kentucky, 1912), which was approved by the Governor March 19, 1912. This act crystallized into law a strong and growing sentiment in the Commonwealth that the time was ripe for a definite forest policy in line with the same character of policies in other States and the Federal Government.

In accordance with the Act the Governor appointed Mr. W. H. Mackoy of Covington, Mrs. Mason Maury of Louisville, and Hon. J. N. Camden of Versailles, as members of the State Board of Forestry to serve with the ex-officio members. The board as thus constituted met August 12 in the Executive Office, organized and initiated action to secure a State Forester. At a subsequent meeting, held August 26, 1912, Mr. J. E. Barton was appointed State Forester, took the oath of office and entered upon the duties of his position September 1, 1912.

In organizing a new department such as the office of the State Forester, necessarily a systematic code of by-laws must be prepared and the State Forester found himself confronted with this work immediately upon undertaking the duties of his position. A set of "Rules and Regulations" was compiled and adopted by the State Board of Forestry October 19, 1912. Also, in the meantime, the State Forester had outlined the routine of the department, installed systems of filing and accounting and generally laid the foundation for a broad development of the department.

EDUCATION.

In view of the fact that the forest policy of the State is a new proposition it early developed that it would be necessary to employ every means and occasion to bring the work to the attention of the people of the Commonwealth.

Addresses.

In pursuance of this idea the State Forester has addressed various bodies and meetings as the opportunity offered on various phases of the forest work. The Farmers' Institutes offered one of the opportunities and the State Forester during the fall and winter of 1912-13 addressed a large number of these institutes when he could do so without interference with his other work. In addition addresses were given before various other bodies and meetings, notably the Hardwood Club of Louisville (which distinguished the State Forester by making him an honorary member), the Kentucky Federation of Women's Clubs, the Out-Door Art League of Louisville, the annual meeting of the State Horticultural Society at Henderson and the annual meeting of the State Farmers' Institute at Paducah. In March, 1913, the State Forester was honored by being requested by resolution to address a joint meeting of the House of Representatives and Senate of Tennessee on forest legislation then pending before these bodies, which he did on March twenty-fourth.

Bulletins.

In December, 1912, an article by the State Forester, "The Future of Forestry in Kentucky and the South," appeared in the Christmas Edition of the Southern Lumberman. The requests for copies of this article became so extended that it was finally published by direction of the State Board of Forestry as a bulletin of the department. A second bulletin, "The Farm and the Woodlot," was prepared and published with particular reference to the small wooded areas which might be maintained on a farm. This bulletin was the result, in part, of points brought out and questions asked while the State Forester was making talks at the Farmers' Institutes during the winter of 1912-13. This bulletin, together with the previous bulletin, was distributed largely at the State Fair of 1913. Among the many requests for information which have been received by the office of the State Forester a considerable number have been for information with regard to shade trees. To make information of this character available an extensive bulletin has been prepared, which is made a part of this report, and will also be published as a part of the Arbor Day and Bird Day Annual of the Department of Education.

In addition to the above bulletins the law creating the State Board of Forestry and the Rules and Regulations of the department were early published in bulletin form. A limited number of small pamphlets and circulars were also published, notably one dealing with Arbor Day.

Publicity.

The State Forester has felt certain that only through the widest publicity can a knowledge of the beneficial results of a forest policy in Kentucky become a part of the consciousness of the people of the State, and he has, consequently, taken advantage of every opportunity to present the activities of the department to the public through the newspapers, magazines and other publications and especially through the educational agencies and clubs. It early appeared that the future welfare of the forests of the State was a matter of concern to the coming generations and the State Board of Forestry took under consideration the best and most feasible way to interest the boys and girls of the State in the growing of trees as a practical, business proposition. The result of this deliberation was that the establishment of Boys' and Girls' Forestry Clubs in the various counties of the State was approved and the State Forester authorized to go ahead with the work. The inwardness of this work is best explained by the report of the committee which considered the matter.

Report of Committee.

(1.) The committee recommends the establishing of Boys' and Girls' Forestry Clubs throughout the State for the purpose of encouraging the planting and care of trees.

(2.) The committee recommends the planting of plantations with fruit trees, peaches and apples, or of nut trees, pecans, chestnut and walnut. Such plantations are not to be less than twenty-five trees in size and such plantations are to be planted by each individual member of the club.

(3.) Instructions shall be issued to each member of the club with regard to the planting and care of the trees, grafting, budding, spraying, pruning, etc. The best fruit and nuts raised in each county from plantations of members of the club shall be judged in the county at some specified date and the best products raised be forwarded to the State Fair for exhibit purposes. The fruit and nuts will both be judged and a premium offered in

each class. A trophy cup will be offered to the individual who on two consecutive years succeeds in any certain class in winning the prize.

J. W. NEWMAN,
JOSEPH H. KASTLE,
J. E. BARTON,
MRS. MASON MAURY,
Committee.

This work has received the active co-operation of the State Department of Education, and although the clubs are hardly started it is the expectation that the work will prove of as useful and vital a nature as the Boys' Corn Clubs have heretofore shown themselves.

FOREST PROTECTION.

In the business world of today insurance in one form or another is an integral part of practically every industry. In the practice of forestry protection of the forests from various destructive agencies is the form which insurance takes. It is inconceivable to formulate a forest policy in which protection of growing timber from fire is not one of the prime essentials. Unless this character of risk can be adequately underwritten it is useless for the State, a corporation or an individual to attempt the practice of scientific forestry. Consequently one of the first considerations of the State Forester was the formation of a broad and adequate scheme of fire protection for the State.

Weeks Law.

By an act of Congress approved March 1, 1911, the United States Secretary of Agriculture was authorized to co-operate with the States in the protection from fire of forested areas at the headwaters of navigable streams, and an appropriation of money was made available for such protection. The co-operation involved the execution of an agreement between the Secretary of Agriculture of the United States and the proper State authorities whereby the Secretary agreed to spend a certain sum for forest fire protection on certain fixed water sheds providing the State entering into the agreement would agree to spend a like amount; in other words, the Federal Government and the State would share equally in the expense of the protection. Already seventeen States have entered into such agreements and Kentucky was the latest State to do so.

But Kentucky is the first State of the real South to enter into such an agreement. Under the terms of the agreement Kentucky was allotted \$4,000 by the United States Secretary of Agriculture for the calendar year 1913 for purposes of forest protection. Later by act of Congress the original appropriation made under the Weeks Law was increased by an annual appropriation of \$75,000.

State Forester's Fire Plan.

With the Federal co-operation outlined above in mind the State Forester submitted to the State Board of Forestry a comprehensive plan of protection against forest fires for the State, which was adopted by the board.

Fire Plan.

1. The State Board of Forestry, through its chairman, shall enter into the usual co-operative agreement with the Forest Service of the United States Department of Agriculture whereby it can secure co-operation with the Federal Government in the matter of fire protection, and take advantage of the \$4,000 allotted by the United States Secretary of Agriculture for that purpose.

2. In pursuance of this agreement the State shall be divided into fire patrol districts for administrative purposes in accordance with a map which is made a part of the fire plan.

3. Two patrolmen at large shall be appointed for the present to serve throughout the year, whose duty it shall be to organize the fire patrol systems in the various counties and see that the system is carried out in full. The salary of such patrolmen shall be \$900 per annum payable monthly and they shall be allowed travelling and field expenses not to exceed \$600 per year.

4. During the danger season for forest fires, approximately three months, patrolmen will be appointed in such counties as the danger warrants.

5. The close co-operation of the Fish and Game Commission will be secured wherever practicable.

6. The active co-operation of timber land owners, railroads, etc., will be encouraged and secured wherever practicable.

In accordance with the fire plan outlined above Mr. Harry J. Price, of Catlettsburg, was appointed District Fire Warden for Eastern Kentucky, and Mr. James T. Buford, District Fire Warden for Southern Kentucky.

FOREST FIRES

The forests of Kentucky represent a great source of wealth to the people of the State, not only because of the timber which they furnish but also because of the wages which are paid each year in cutting the timber in the woods and in manufacturing it. A forest also affords the most effective means of preventing floods and maintaining the regular flow of streams. The great annual destruction of forests by fire, therefore, is an injury to all citizens of the Commonwealth and greatly hampers our industrial progress.

In order to prevent forest fires the General Assembly of Kentucky passed a law, approved March 19, 1912, which forbids setting fire to forests and provides penalties as follows:

"Any person or persons who shall kindle fires upon any of the forestry reservations of this Commonwealth, except in accordance with such rules and regulations as may be prescribed by the said Board of Forestry, or who shall cut and remove any timber whatever, or who shall do or cause to be done any act that will damage forest lands or timber belonging to the Commonwealth, shall be guilty of a misdemeanor and upon conviction thereof be subject to a penalty not exceeding five hundred dollars for each offense committed with cost of suit. If the defendant or defendants neglect or refuse to pay the penalty and costs imposed, he or they shall be committed to jail of the county there to remain until such penalty and costs are paid, but no longer than one day for each and every two dollars of the fine and costs imposed.

It shall be unlawful for any persons or corporation, as land owner, to set, or procure another to set fire to any woods, brush, logs, leaves, grass, or clearing upon their own land, unless they shall have previously taken all possible care and precaution against the spread of such fire to other lands not their own, by previously having cut and piled the same, or carefully cleaned around the land which is to be burned, so as to prevent the spread of such fire. The setting of fire contrary to the provisions of this section, or allowing it to escape to the injury of adjoining lands, shall be prima facie proof of recklessness or neglect, and the land owner from whose land the fire originated shall be liable in a civil action for damages for the injury resulting from such fire, and also for the cost of fighting and extinguishing the same.

Logging and railroad locomotives, donkey or threshing engines, and other engines and boilers, operated in, through or near forest or brush, which do not burn oil as fuel, shall be provided with appliances to prevent as far as may be possible the escape of fire and sparks from the smokestacks thereof and with devices to prevent as far as may be possible the escape of fire from ash pans and fire boxes. Failure to comply with these requirements shall be a misdemeanor, punishable upon conviction, by fine of not less than \$10 nor more than \$100 for each and every offense committed.

All individuals and corporations causing fires by violation of any of the provisions of this act shall be liable to the State or the county in which the fire occurred for all damages the State or the county may sustain by such fire or fires and in addition thereto to the full amount of all expenses incurred by the State or county in fighting or extinguishing said fire.

Justice of the Peace for this State, in the county wherein the offense shall have been committed, shall have the jurisdiction to hear and determine all prosecutions for the purpose of enforcing fines and penalties, collectable under the provisions of this act, not exceeding the amount of \$100 and of holding the offender, under proper bail if necessary, for hearing before the Circuit Court, and committing him to the county jail until such hearing if the required bail is not furnished. It shall be the duty of the Commonwealth and County Attorneys of the several counties and Circuit Court Districts to prosecute all violators of this act."

For the purpose of enforcing this law all Forest fire wardens shall, while holding office, "possess and exercise all the authority and power held and exercised by constables at common law and under the statutes of this State."

THE EXERCISE OF CARE WITH SMALL FIRES IS THE BEST PREVENTIVE OF LARGE ONES
Therefore, all persons are requested

1. Not to drop matches or burning tobacco where there is inflammable material.
2. Not to build larger camp fires than are necessary.
3. Not to build fires in leaves, rotten wood, or other places where they are likely to spread.
4. In windy weather and in dangerous places, to dig ditches or clear the ground to confine camp fires.
5. To extinguish all fires completely before leaving them, even for a short absence.
6. Not to build fires against large or hollow logs, where it is difficult to extinguish them.
7. Not to build fires to clear land without taking the greatest precaution against the spread of fire and to

refrain from clearing land in this manner in windy or exceedingly dry weather.

This notice is posted for your benefit and for the good of every resident of the region. You are requested to co-operate in the enforcement of its provisions and in preventing its removal or defacement.

By authority of the State Board of Forestry

J. E. BARTON,

STATE FORESTER

FOREST FIRE WARNING.

It early appeared in this work that the heaviest stands of timber and the greatest danger from forest fires were in the southern and eastern portions of the State, consequently the County Fire Wardens so far appointed have been confined to those regions. Altogether thirteen County Fire Wardens have been appointed as follows:

Frank Brandenburg	Owsley County
S. S. Cassity	Rowan County
E. H. Dunn	Leslie County
J. D. Jones	Harlan County
Harlan Lutes	Lee County
G. B. Lyttle	Knox County
J. H. Mays	Elliott County
J. C. Newberry	Martin County
E. P. Rader	Jackson County
David Stephens	Magoffin County
J. M. Wheeler	Morgan County
James Winn	Estill County
T. Garrett Ford	Bell County

In pursuance of Section 17 of the Act, fire notices have been placed in the hands of the County Fire Wardens for posting. It is too early in the work to forecast the benefits to be derived from the operation of this plan, but that it has in it the merit of meeting a real need in the Commonwealth is manifested by the interest already displayed by timber land owners, particularly in Bell, Rowan, Letcher, Johnson and Floyd counties, where active steps for co-operation with the State in its fire protective program have been taken. It is the opinion of the State Forester that in order to organize the work county fire protective organizations should be formed by the timber land owners in each county where the work is of moment and that these county associations should co-operate with the State Forester's office and the County Forest Warden appointed by him. At a recent meeting in Rowan County, where the State Forester addressed a limited number of timber land owners of the county, those present agreed that this was the advisable method of handling the proposition, and a committee of three, including the County Forest Warden, and two of the largest timber land owners was appointed to go ahead and complete the organization. It was brought out at the meeting that the daily payroll from the timber industries of Rowan County is at least \$2,000, which means that the citizens of Rowan County derive about

\$700,000 in wages each year from their timber resources. It is perfectly patent, then, that the protection of the timber supply is a plain business proposition, a bread and butter matter, with each citizen of the county and should be so regarded. It is hoped and expected that the matter will appeal to other counties in a like manner, and the indications are favorable that such associations as that under way in Rowan County will be largely organized, especially in Eastern Kentucky.

VALUE OF FIRE PROTECTION.

To put a money value on forest protection for Kentucky, based on the facts and data available at the present time, is a hazardous and uncertain matter; but an estimate of this character is of interest as showing a concrete money value for the subject in which we are dealing. The lumber cut in Kentucky in 1912 was 641,296,000 feet, board measure, representing a money value of approximately \$13,000,000 at the mill, but this statement does not include the amount and value of ties, poles, etc., so that it seems safe to say that the total amount of all forest products in Kentucky in 1912 was 700,000,000 feet, board measure, with a value of \$15,000,000. Basing the amount paid out in wages in the cutting and manufacturing of wood products on the actual figures from Rowan County, the wage value of the forests of Kentucky would be \$84,000,000, but taking into consideration the thinly wooded portion of the State it is reasonable to assume that the wage value of the forests of Kentucky is approximately \$50,000,000. The forests of Kentucky, then, represent an annual value of at least \$65,000,000 to the Commonwealth. So that it may be said that forest protection represents an insurance valued at \$65,000,000 annually to the State of Kentucky. To borrow a phrase of the Western Conservation Association, "Forest Protection is Property Insurance."

FOREST EXTENSION.

One of the first projects authorized by the State Board of Forestry was the establishment of two forest tree nurseries, one at Louisville and one at Frankfort. In establishing these nurseries it was proposed by the Board to place within reach of the citizens of the Commonwealth a commercial supply of those

forest tree species most adapted to reforestation and afforestation suitable areas throughout the State and to encourage reforestation and afforestation by supplying the necessary tree material either free or at a cost to citizens upon the signing of a simple agreement on the part of the individual to use the material obtained for the purposes above outlined. Underlying the work of forest extension there are roughly two classes of land in the Commonwealth: (1) land which is chiefly valuable for agriculture; (2) land which can never be profitably devoted to agriculture for a variety of reasons. This last land can produce and should be producing forest crops, and, if it is not so doing, there is an economic waste. In order to prevent this waste and to encourage the production of timber crops the State nurseries have been established.

Louisville Nursery. The forest tree nursery at Louisville has been established on twenty-five acres of land which is a part of the State Fair grounds and adjacent to twenty acres of land occupied by the Federal Government as a fish hatchery. The use of the land was secured by a co-operative agreement between the State Board of Forestry and the State Board of Agriculture. Recently a boulevard between Shawnee Park and Greenwood Avenue has been surveyed by the city of Louisville and will be immediately constructed so that the advantages of the site will be enhanced. It is the intention to emphasize strongly at this nursery the educational phase of the work during the week of the State Fair and at other times, and as soon as the stock is available a demonstration forest will be developed. At present there are thirty-six seed beds in the nursery and the capacity of these beds is 400,000 seedlings. Ten beds have already been planted and the balance will be planted as soon as the fall supply of seed is available. Additional seed beds will be added to the nursery during the spring of 1914. The species which have been selected for planting at the present time are as follows:

Conifers.

1. White pine (*Pinus strobus*).
2. Shortleaf pine (*Pinus echinata*).

Hardwoods.

1. Walnut (*Juglans nigra*).
2. Hickories.
 - a. Shagbark (*Hicoria ovata*).
 - b. Pignut (*Hicoria glabra*).

- c. Mockernut (*Hicoria alba*).
- d. Pecan (*Hicoria pecan*).
- 3. Chestnut (*Castanea dentata*).
- 4. Oak.
 - A. White oaks.
 - a. White oak (*Quercus alba*).
 - b. Bur oak (*Quercus macrocarpa*).
 - c. Post oak (*Quercus minor*).
 - B. Black oaks.
 - a. Red oak (*Quercus rubra*).
 - b. Pin oak (*Quercus palustris*).
- 5. Elms.
 - a. White elm (*Ulmus americana*).
 - b. Rock elm (*Ulmus racemosa*).
- 6. Tulip tree (*Liriodendron tulipifera*).
- 7. Cucumber tree (*Magnolia acuminata*).
- 8. Sweet gum (*Liquidambar styraciflua*).
- 9. Wild black cherry (*Prunus serotina*).
- 10. Black locust (*Robinia pseudacacia*).
- 11. Maples.
 - a. Sugar maple (*Acer saccharum*).
 - b. Red maple (*Acer rubrum*).
 - c. Box elder (*Acer negundo*).
- 12. Ohio buckeye (*Aesculus glabra*).
- 13. American linden (*Tilia americana*).
- 14. Ashes.
 - a. White ash (*Fraxinus americana*).
- 15. Catalpa (*Catalpa speciosa*).

The species enumerated are all distinctly commercial species, but in addition several species of a purely ornamental value will be added from time to time. A bed of ginkgo seeds has already been planted and several other species.

In connection with the establishment of the Louisville nursery one of the first difficulties encountered was in connection with a water system. It has been found necessary to dig a 75-foot well and install a pump. Next year when the nursery is well under way it will be further needful to construct a tower and water tank and install a gasoline engine for operating the pump, since in no other way is it at present possible to supply the requisite water. An experiment with wild stock has been undertaken by transferring available beech, sweet gum and other species to the transplant beds where stock of the proper age could be found. There have already been requests for stock from this nursery; but

it is not expected that shipments can be made before the fall of 1914.

FOREST TAXATION.

Forest taxation is one of the fundamental propositions in which the practice of scientific forestry is based. Given adequate forest protection and a system of forest taxation wherein the taxes may be definitely calculated for a period of years both on land and crop and where the burden of taxation will fall on the crop at the time of maturity and scientific forestry may be safely practiced and reforestation and afforestation of suitable areas will be undertaken. Without either or both of these basic premises the practice of scientific forestry becomes more or less a gamble, unsuitable for a long-time investment, since the essence of any long-time investment is reasonably certain returns, even though these returns may be small. In the history of American forestry it has been possible to reduce all factors of practice and cost in the growing of forest crops to a matter of mathematical calculation within certain narrow limits, except that forest fire protection and forest taxation have remained matters of speculation and uncertainty. Within the last decade, however, the matter of fire protection, especially in certain regions, has lost a large share of its uncertain elements and the studies made in this direction bid fair to solve the problem within a short space of time. Forest taxation, however, is a factor in scientific forestry which has received scant consideration up to the present time and yet it is holding back the reforestation and afforestation in the United States to an incalculable degree. Within the last few years, then, forest taxation has become the subject of a great deal of attention on the part of the individuals and States where forestry as a practice is making the greatest headway. A considerable body of literature has appeared on the subject and a few States have enacted into law the best thought of the day upon the question, notably Pennsylvania, New York and Connecticut. In considering the problem of forest taxation there is one thing which seems to be agreed and that is that taxation of the land upon which forest crops are grown must be a separate proposition from taxation of the forest crop because of the time which it takes a forest crop to mature. When corn lands and the crop are taxed an annually recurring state is being considered since the ground is planted and the corn harvested with-

in one growing season. But a forest crop takes many growing seasons for its fruition and only at the time of harvest is the actual value of any crop definitely fixed. It is logical to insist, therefore, that when land is devoted to the raising of forest crops, the land, as such, shall be taxed annually and the tax definitely fixed throughout the entire rotation or period of growth of the forest crop; further that the forest crop shall be taxed at the time of harvest by the diversion of a fixed per cent. of its market value to the proper governmental channels. The details on which such a system of taxation might be worked out will depend largely on the feature of the general plan of taxation within the individual State; but the underlying principles would remain unchanged. Pennsylvania's laws on this subject bear on the face of them the impress of intrinsic merit since they contain no undue elaboration by which the actual execution of their provisions might be seriously hampered and the whole proposition vitiated.

STATEMENT OF EXPENDITURES OF STATE FORESTER'S OFFICE.

FISCAL YEAR 1913.

Date of 1912.	Character of Expenditure.	—Disbursements—		Appropriation.
		Current.	Total.	
9/30	Geo. L. Barnes (Stamps).....	\$5.00	\$5.00	\$15,000.00
9/30	Frankfort Transfer Co.	1.00	6.00	
9/30	Payroll (September)	208.33	214.33	
10/7	Expense Acct. (JEB)	42.05	256.38	
10/12	Kentucky State Journal	8.25	264.63	
10/19	Geo. L. Barnes	5.00	269.63	
10/23	Geo. G. Fetter Co.....	95.25	364.88	
10/31	Payroll (October)	273.33	638.21	
11/1	Underwood Typewriter Co.	83.03	721.24	
11/7	Geo. L. Barnes	5.00	726.24	
11/13	Kentucky State Journal	4.43	730.67	
11/14	Expense Account (Maury).....	9.10	739.77	
11/30	Payroll (November)	283.33	1,023.10	
12/24	Cumberland Tel. & Tel. Co.....	1.45	1,024.55	
12/26	Kohler Mfg. Co.	4.25	1,028.80	
12/8	Expense Account (JEB)	35.43	1,064.23	
12/10	Frankfort Home Tel. & Tel. Co.....	2.50	1,066.73	
12/10	Kentucky State Journal	27.07	1,093.80	
12/19	Geo. L. Barnes	20.00	1,113.80	
12/23	Payroll (December)	283.33	1,397.13	
1913.				
1/4	Adams Express Co.	10.01	1,407.14	
1/13	Cumberland Tel. & Tel. Co.	4.15	1,411.29	
1/13	Frankfort Home Tel. Co.	2.50	1,413.79	
1/16	Kentucky State Journal.....	3.17	1,416.96	
1/30	Expense Account (JEB)	43.42	1,460.38	
1/30	Guy Barrett	8.50	1,468.88	
1/31	Payroll (January)	283.33	1,752.21	
2/4	Geo. L. Barnes	20.00	1,772.21	
2/5	Frankfort Trans. Co.	1.00	1,773.21	
2/5	Frankfort Home Telephone Co.....	2.50	1,775.71	
2/8	Cumberland Tel. Co.	2.75	1,778.46	
2/27	Expense Account (JEB)	27.85	1,806.31	
2/28	Payroll (February)	283.33	2,089.64	
2/28	Frankfort Home Tel. Co.	2.75	2,092.39	
3/1	Cumberland Tel. & Tel. Co.	2.75	2,095.14	
3/19	Kentucky State Journal	7.18	2,102.32	
3/28	Geo. L. Barnes	25.00	2,127.32	
3/31	Payroll (March)	283.33	2,410.65	

4/1	Expense Account (JEB)	26.20	2,436.85
4/5	Frankfort Home Tel. Co.	2.50	2,439.35
4/7	Cumberland Tel. & Tel. Co.	4.05	2,443.40
4/10	Kentucky State Journal	12.19	2,455.59
4/24	Adams Express Company.....	.75	2,456.34
4/30	Payroll (April)	283.33	2,739.67
5/8	Cumberland Tel. Co.	3.15	2,742.82
5/13	Expense Account (Maury)	8.75	2,751.57
5/14	Frankfort Home Tel. Co.....	2.50	2,754.07
5/15	Expense Account (JEB)	39.10	2,793.17
5/15	Kentucky State Journal	47.52	2,840.69
5/17	Lewis & Chambers	22.50	2,863.19
5/26	Geo. L. Barnes	25.00	2,888.19
5-31	Expense Account (JEB)	20.90	2,909.09
5/31	Payroll (May)	283.33	3,192.42
6/3	W. H. Cook	260.00	3,452.42
6/5	Cumberland Tel. Co.	3.25	3,455.67
6/15	Expense Account (JEB)	27.00	3,482.67
6/19	Kentucky State Journal	23.69	3,506.36
6/19	Frankfort Home Tel. Co.	2.50	3,508.86
6/19	Capital Typewriter Co.	33.33	3,542.19
6/21	Guy Barrett	33.50	3,575.69
6/30	Expense Account (JEB)	21.40	3,597.09
6/30	Payroll (June)	283.37	3,880.46
6/30	Frankfort Home Tel. Co.	3.10	3,883.56
6/30	Cumberland Tel. Co.	2.75	3,886.31

**STANDARDIZED DISTRIBUTION OF THE EXPENDITURES OF THE
OFFICE OF THE STATE FORESTER FOR THE FISCAL
YEAR 1913, BEGINNING JULY 1, 1912,
AND ENDING JUNE 30, 1913.**

1.	Salaries	\$2,748.34
2.	Wages	260.00
3.	Traveling expenses	298.10
4.	Transportation of materials.....	15.86
5.	Subsistence .....	.....
6.	Communication	151.15
7.	Advertising, printing and binding	133.50
8.	Equipment, office	257.86
9.	Equipment, field	21.50
10.	Miscellaneous .....	.....
Total		\$3,886.31

OUTLINE OF WORK FOR YEAR 1914.

The work during the fiscal year 1914 will follow in general the same plan as the work heretofore undertaken.

Education. The educational features of the work will be emphasized in every way possible and the real needs of the State along forestry lines will be considered in the bulletins, circulars, etc., issued. A bulletin is already under way dealing with the growing of posts in the State, which is one of the matters concerning which the office of the State Forester has received most frequent inquiry. Especially is it the intention to bring forestry into the schools, emphasizing forests in their economic relation as a source of material wealth to the State and a means of conserving the purity and continuity of the water supply. The Boys' and Girls' Forestry Clubs will be pushed and addresses given widely as the opportunity offers.

Forest Extension. The forest nursery at Louisville will be very materially increased in capacity both in the spring and fall of 1914, and the distribution of seedlings from this nursery will be possible in the fall of 1914. A nursery at Frankfort will be in all probability established in the spring of 1914 with an initial sixty acres of ground belonging to the Kentucky Normal and Industrial Institute for Colored Persons, and in connection with this nursery instructions will be given the colored students in nursery practice and the care of trees. Seedlings from both the Louisville and the Frankfort nurseries will be furnished to the citizens of the State at cost or free as the State Board of Forestry may hereafter determine.

Forest Protection. In the light of our present experience the plan of protection from forest fires will be continued, enlarged and made more effective. An allotment of \$4,000, made by the United States Secretary of Agriculture, will again be available during the calendar year of 1914, and with a definite knowledge of the period during which forest fires are liable to occur, of the most common causes of forest fires, and the areas where fires are most frequent the organization can be built up and perfected into an effective machine for the prevention and suppression of forest fires. The co-operation of all interests concerned may confidently be counted on in view of the approbation of the system already expressed. A system of lookout points is contemplated so that the

individual patrolman can cover a much wider scope of country than is otherwise possible, and means of communication from such lookout points is an integral part of such a plan. The telephone and telegraph companies, mail-men on rural routes and every other available means will be pressed into service so that forest fires may early be detected and quickly controlled. Efforts will be directed toward the formation of associations of timber land owners in the various counties to co-operate with the office of the State Forester in the prevention and suppression of forest fires. The encouragement already met with in this direction is promising.

Purchase of Land and Establishment of Forest Reservations.

The systematic purchase of land for the purpose of forest reservations whereon scientific forestry may be practiced and demonstrated will be begun at an early date and is contemplated in the plan of expenditures which is a part of this report. It is keenly realized by the State Board of Forestry that in no way can the value of the practice of scientific forestry as a business proposition be so clearly demonstrated as by concrete examples. It is possible at the present time to secure suitable land for this purpose at very reasonable prices, considerably less than the limit of \$10.00 per acre set by law, and the opportunity should not be wasted. Just where this land will be located has not been determined; but there are three main points which the board has in mind; suitability of the land for the purpose, low purchase price and value of the site as a demonstration area because of accessibility and other features.

Studies. It is expected to initiate some studies both in regard to the waters of the State and the forest supply. Requests are constantly being received by the State Forester with regard to the timber supply of certain counties or regions. While a study of the timber supply of the State was made some time ago by the then Kentucky Bureau of Agriculture, Forestry and Immigration in co-operation with the United States Forest Service, and this information is valuable, nevertheless conditions with regard to the timber supply of the State have so materially changed that a new compilation of facts with regard to Kentucky's timber supply, its extent, location, rapidity with which it is being cut, etc., is much to be desired.

A study of the waters of the State—or at least a beginning in this direction—is a real economic need. This study should be made

with an eye to the unfortunate flood conditions which have been of recent occurrence and with regard to the possible development of streams for navigation and water power.

STATE FORESTER'S RECORD OF ALLOTMENTS AND EXPENDITURES.

For the purpose of the standardization of the expenditures and receipts of the State Forester's office, the character of expenditures have been made into ten classes as follows:

1. Salaries.
2. Wages.
3. Traveling Expenses.
4. Transportation of Materials.
5. Subsistence.
6. Communication.
7. Advertising, Printing and Binding.
8. Equipment, Office.
9. Equipment, Field.
10. Miscellaneous.
 - (1.) Salaries—The salaries of all men under appointment.
 - (2.) Wages—Temporary assistants and laborers.
 - (3.) Traveling Expenses—This allotment will include the transportation of persons, including railroad fare, Pullman, steamship, boat hire, automobile hire, livery, lodging and subsistence.
 - (4.) Transportation of Materials—Freight, express, drayage, etc.
 - (5.) Subsistence—Supplies, etc., for temporary laborers.
 - (6.) Communication—Telegraph, telephone, postage, telephone rental, etc.
 - (7.) Advertising, printing and binding.
 - (8.) Equipment, Office—Office supplies, including stationery, books, photographic and drawing supplies, office furniture, etc.
 - (9.) Equipment, Field—Live stock, tools, tents, etc., for use by the field force.
 - (10.) Miscellaneous—Expenditures which cannot be classified under the above headings.

**REPORT OF THE FINANCIAL COMMITTEE OF THE STATE BOARD
OF FORESTRY EMBODYING ESTIMATE AND
PLAN FOR FISCAL YEAR, 1914.**

(1.) Salaries.		
(a.) Office force.		
State Forester	\$2,500.00	
1 stenographer and typewriter.....	900.00	
(b.) Field force.		
1 nurseryman	900.00	
	<hr/>	
Total		\$4,300.00
(2.) Wages		250.00
(3.) Traveling Expenses.		
(a) Office force	\$ 600.00	600.00
(4.) Transportation of Materials.		
Express	50.00	
Drayage	20.00	
Freight	30.00	
	<hr/>	
Total		100.00
(5.) Subsistence		100.00
(6.) Communication.		
Telephone rental	\$63.00	
Telephone tolls	36.00	
Telegrams	24.00	
Stamps	120.00	
	<hr/>	
Total		243.00
(7.) Advertising, Printing and Binding.....		200.00
(8.) Equipment, Office		100.00
(9.) Equipment, Field		700.00
(10.) Miscellaneous		100.00
A. Co-operation work with Federal Government.....		3,000.00
B. Boys' and Girls' Club work.....		1,000.00
C. Purchase of land		500.00
D. Unallotted balance		3,807.00
	<hr/>	
Grand total		\$15,000.00

Signed: J. W. NEWMAN,

Signed: JOSEPH H. KASTLE,

Signed: J. E. BARTON,

Committee.

RECOMMENDATIONS OF THE STATE FORESTER.

The recommendations of the State Forester are as follows:

Administration:

1. That the campaign of publicity and education inaugurated by this office be continued by the publication of useful bulletins from time to time, by talks and lectures, articles and circulars, and especially by interesting the school children in the practice of forestry as an economical consideration, and in the control and conservation of the waters of the Commonwealth as a matter of great public benefit and concern.

2. That the systematic purchase of suitable land for forest reserves—especially cut-over land—be continued and the amount purchased increased while such land can be purchased for reasonably low prices.

3. That the Louisville Nursery be made more efficient by the erection of a storehouse for seeds, tools, etc., and that next spring an engine be purchased to operate the pump and a tank erected for storage of water in anticipation of the summer season and the increased capacity of the nursery. Also that work on the nursery at Frankfort be held in abeyance until the nursery at Louisville is well under way.

4. That the fire protective system inaugurated at the fall of 1913 be amplified during 1914 by the appointment of a county fire warden in practically every one of the eastern counties of the State; that suitable lookout stations be selected and equipped in Eastern Kentucky to the number of five at least for the early detection of forest fires, and that these lookout stations be built and equipped so that they will be ready for use during the fall of 1914. That a standing reward of \$25 be offered for the arrest and conviction of any individual caught setting fire to the woods or forests within the State.

Legislation.

1. That a law be passed enabling the Federal Government to purchase and own land within the Commonwealth of Kentucky for the purpose of creating and administering national forests.

2. That definite laws be enacted with relation to forest taxation, so that the reforestation of waste lands and cut-over lands suitable for raising forest crops may be encouraged and placed on a sound business basis, and that such legislation embody the following features:

a. Taxation of the land separate from the forest crop by an annual tax fixed during a period of years.

b. Taxation of the forest crop at the time of maturity by assessing the crop at a certain reasonable per cent. of the then market value.

c. Necessary machinery for carrying out the purport of the law.

3. That the present forest law be amended to permit co-operation with the Federal Government to the extent of \$5,000 instead of \$3,000.



WHITE ELMS—ULMUS AMERICANA.
(An unusually attractive natural grouping)

SHADE TREES.

INTRODUCTION.

With every passing year the interest of the citizens of Kentucky in the shade trees of the cities, towns and villages, along public highways and on private lands and estates has become more keen, for the reason that our people as a whole are gradually coming to an appreciation of the worth of individual trees and of tree communities from an aesthetical point of view and are alive to their value as factors for health and comfort in the community. This is a natural development in line with an awakening public interest in parks, public playgrounds, better roads and highways and the development of attractive surroundings on the farm. In all of this the trees play a very important part. Then, too, throughout the State the present shade trees, which are to a very considerable extent remnants of the original forest, are decaying, deteriorating and dying. Their owners are interested most decidedly in their preservation, if possible, and their replacement if this must be done. Again within recent years the increase of insect pests and fungus diseases due to the introduction of new species and varieties from foreign countries and the importation of European nursery stock has caused widespread comment. Insect infestations among our tree friends, a condition which has been emphasized by the lack of natural enemies to keep them in check and a notable decrease in our native birds that prey on insects, have been of frequent occurrence. In cities the paving of streets, construction of sidewalks, laying of sewers and gas and water mains, conduits for electric light, telephone and telegraph wires all has very seriously disturbed natural conditions and endangered the life of the shade trees.

While it is realized that the care and protection of shade trees is not strictly within the province of forestry, yet requests for information in this direction have so continually come to the office of the State Forester that it has seemed best to compile a bulletin on this subject, which shall supply as far as possible information along these lines to the people of the State. No new information is contemplated in this bulletin. It is simply a gathering together of pertinent information from every available source and presenting it with especial reference to Kentucky conditions and needs.

SHADE TREE LEGISLATION.

The only general shade tree legislation for the State which I have been able to find is that contained in Chapter 110, Section 81, of the Acts of Kentucky for 1912, which reads as follows:

“The County Road Engineer may, by an order in writing, authorize the owners of property adjoining the public roads, at their own expense, to locate and plant shade trees, fruit trees or nut-bearing trees suitable for shade along the public road. Such trees not to be planted within less than fifteen feet of the center of the road. Such trees shall be planted at least sixty feet apart and according to plans and regulations sent out by the State Commissioner of Public Roads.”

This is satisfactory so far as it goes, but it seems to me that the day is not far distant when an act will be necessary dealing specifically with shade trees along the public roads and highways and along the streets of cities, towns and villages, for such trees, no matter by whom planted or cared for, are on public property. For instance, at present there is no law covering the cutting, trimming and topping of shade trees by public service corporations, such as telephone and telegraph companies. The work done on trees by these companies in an effort to clear their transmission lines from adjacent tree growth is now wholly unregulated, lacks supervision and uniformity, is usually done by individuals who know nothing of tree pruning or trimming and most often amounts to butchery of the tree. Also tree surgeons in the State should be taxed and licensed, and preferably examined as to their competency before being allowed to practice. The same is true of individuals who make a business of trimming and pruning shade trees. It has been my observation in various parts of the State that so-called tree surgery is the veriest kind of quackery and large sums of money spent by our citizens for this purpose have been totally thrown away.

In some States a considerable body of legislation covers the shade tree problem, and in Massachusetts, where the ravages of the gypsy and brown tailed moths upon the shade and other trees of the State have been most alarming, the suppression of these pests has become a matter for public concern and legislative action looking to the control of the depredations.

CHOICE OF SPECIES.

Broadly speaking the species of trees to be planted extensively for shade trees in any State should be largely confined to the trees native to the State, for these have shown themselves to be especially adapted to the soil, climate and other features of the region. What tree shall be planted in any particular place depends on the local surroundings (such as width of street or highway), site (whether on bottom lands or hills) and soil (whether sand, clay or loam; whether wet, moist or dry). The range of species native to Kentucky which may be utilized for shade trees affords varieties for almost any condition and offers one an extensive choice. Late in this bulletin a description of a large number of species will be given together with their silvicultural characteristics, so that a selection may be made.

TIME TO PLANT.

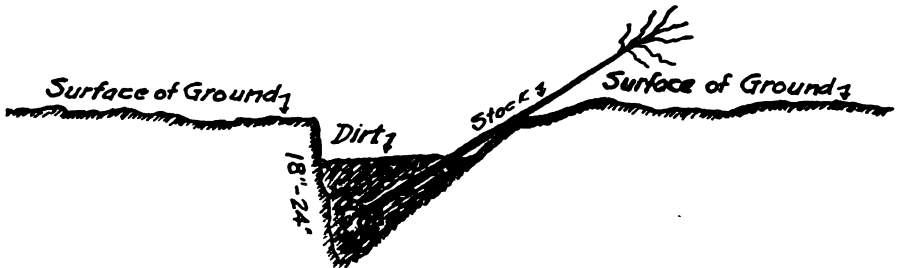
In Kentucky there are two seasons of the year when planting of trees may be advantageously done, in the late fall and in the early spring. Of the fall months, planting can best be done in late October and throughout November. In certain years the planting season may safely be extended into December. In the spring the best time for this work is the latter part of February, March and April; although under certain conditions the latter part of April may be too dry for successful operations. The chief question here is one of moisture. It is essential that the root system of the tree shall not dry out. The seasons of the year indicated are those when the greatest amount of precipitation may naturally be expected.

TREATMENT OF STOCK BEFORE PLANTING.

There are two kinds of stock which are available for planting, nursery stock and wild stock.

Nursery Stock. This is by far the best material for planting, and for these reasons: It has been raised in a nursery and transplanted from time to time in the transplant beds. The advantage of this is that an extensive and compact root system has been developed while the crown of the tree has been reduced to the smallest feasible size. This is vital when the tree is planted eventually in the place where it will mature; for the root system must develop first to nourish an adequate crown and support it

mechanically. Stock grown in the nursery is more easily handled than wild stock, and the nurseryman has on hand all the material necessary for packing the trees properly so that they may be in the best condition possible when they reach their destination. Stock should be planted immediately upon its receipt. If this is not possible immediately upon receipt of the material the trees should be "heeled in;" that is the roots laid in a trench 18 to 24 inches deep and covered over with earth which should be firmly packed about them. Plenty of water should be used during this operation, since it is essential that the root system does not dry out. Drying out of the root system is the chief cause of mortality in planting operations. The "heeling in" process is graphically represented in the following diagram:



Heeling-in Process.

Wild Stock. Undoubtedly, wild stock can be used for planting, if easily available, but it has the disadvantages cited above. If the wildling has attained any size, the root system is apt to be very spreading, and the crown straggling. Under these conditions in obtaining wild stock for planting it should not ordinarily be the aim to get large trees. Small individuals not more than eight feet high and less are desirable. As much of the root system as feasible should be taken, and, if practicable, the dirt should be left on the roots. The crown should be cut back very decidedly. If the tree is to be transported any distance, the roots should be thoroughly well wrapped in damp moss, moist gunny sacks and fine straw, or even rags. Remember the essential thing is that the roots do not dry out.

Larger wild stock than I have indicated may be secured and used, but the difficulties of handling it and the chances of its dying increase very decidedly the larger the tree is.

PLANTING.

It is remarkable how carelessly most planting operations are conducted; yet it has been shown that whether the tree lives or not is very largely dependent on this operation. If extensive planting is to be done, I am very much of the opinion that dyna-

nite is the cheapest and most expeditious way of digging the holes. This is particularly true if the ground is at all rocky or is very firmly packed. Digging holes with dynamite is accomplished by marking first where the holes are to be, taking a piece of tool steel about two inches in diameter and three feet long and driving holes about two feet deep. A half stick of dynamite is then provided with a fuse of sufficient length to allow of easy ignition (about four feet) and dropped in the bottom of the hole, which is then tamped with sand, if available, or loose dirt. If the earth in which the holes are being dug is quite "loose," one-quarter of a stick of dynamite is sufficient. The effect of the dynamite is to stir up the earth adjacent to the hole thoroughly and render it mechanically pervious to the roots of the trees. If obtainable, a dynamite of low per cent. should be used. If the hole is dug by hand, it should be made of sufficient size so that the dirt is thoroughly stirred up around the tree, even though it is necessary partly to fill it up again when the tree is set. A hole three feet square by two feet deep is of sufficient size for small trees. The point here is that the soil adjacent to the newly planted tree may be porous and pervious to the roots so that moisture may be easily obtainable during the time that the tree is endeavoring to establish itself. Beech trees are hard to transplant; but when a very large hole is dug for the reception of the transplant or wildling and then filled in partially before the tree is actually set, young beeches may be successfully transplanted. If the dirt in any particular situation is not especially rich and it is possible conveniently to obtain rich loam from adjacent lands for filling up the hole prepared for the tree's reception, the chances of the tree's living are greatly increased.

In the actual setting of the individual the tree should be placed at about the same position with relation to the surface of the ground as it originally occupied or an inch or so lower. The roots should be spread out in as nearly a normal position as practicable. The earth should then be filled in firmly around and over the root system, except that about two inches of dirt at the top of the ground should be left loose as a mulch. If the tree has a tap root, as for instance the burr oak, the earth should be firmly tamped around this root. Plenty of water should be used during the operation of planting.

DANGERS TO YOUNG TREES.

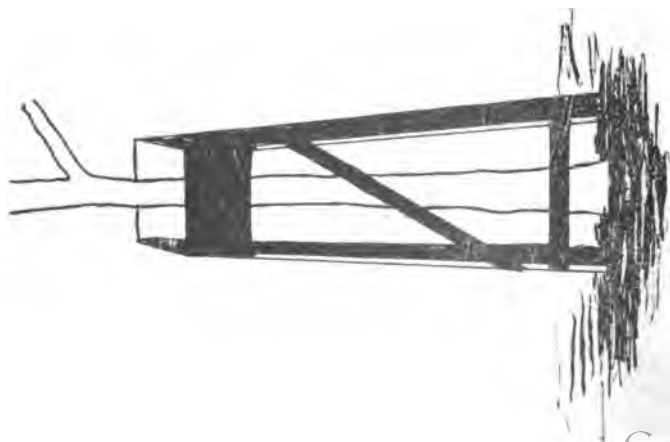
Sun-Scald. A newly planted tree, especially one which has come from a crowded nursery or from the woods, is liable to sun-scald before it is established. This occurs along the southern or southwestern exposure, and results from the killing by the hot sun of the living layer of cells (called the cambium layer) just beneath the bark. The first visible indications of sun-scald is the drying up of the bark on the exposures above indicated. Eventually the bark cracks vertically, pulls apart and peels off or curls up in lengthwise strips. The sapwood will be found to be dead and often an ugly scar results which may or may not heal over. Frequently the injury affords a point of attack for fungus diseases and insects so that the tree eventually becomes hollow. Sun-scald may be guarded against by placing a box of slats or lath around the tree.

Mutilation. Young trees, especially if they are in a street or highway, should be protected from mutilation by animals, such as horses, cows, etc. Horses which have been left standing adjacent to trees frequently gnaw the bark and eat the foliage. Cows very often eat the whole top of the tree away or rub against the tree so as to injure it seriously. Where there are no stock laws serious injury and permanent disfigurement of the tree may result, if the tree is not entirely killed. Wounds caused by gnawing or rubbing offer excellent points of attack for insects or fungus diseases. To guard against injuries of this character it is advisable to place boxes around exposed trees. A good box is made from two pieces of board of suitable heights nailed together with strips of board or slats. (See figure 1, page 58a). Ornamental iron guards are manufactured for this purpose.

PRUNING TREES.

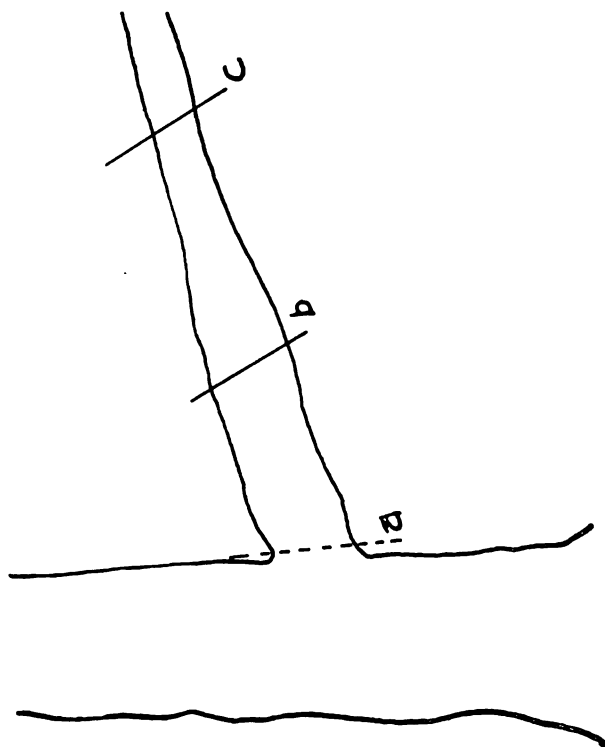
The pruning of shade trees is a matter which deserves a great deal more attention that it has heretofore received. The ordinary man who attempts this work has his ideas of pruning based on experience he may have had in handling fruit trees. The same methods do not apply at all, since the aims, in the main, are widely different. Very often the trees are simply butchered and left mutilated and unsightly so that early decay and death result.

FIG. 1



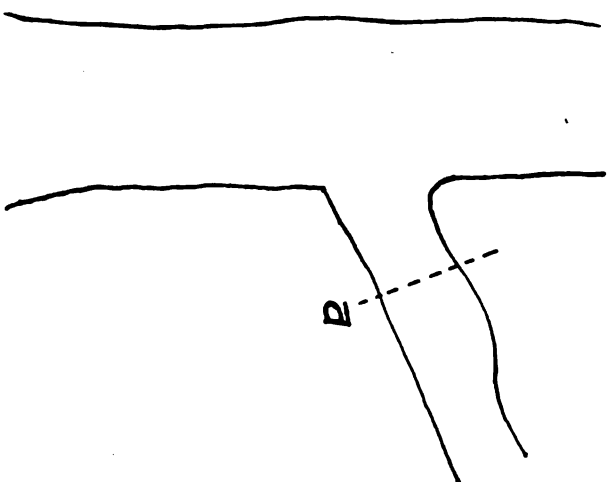
TREE BOX.

FIG. 2



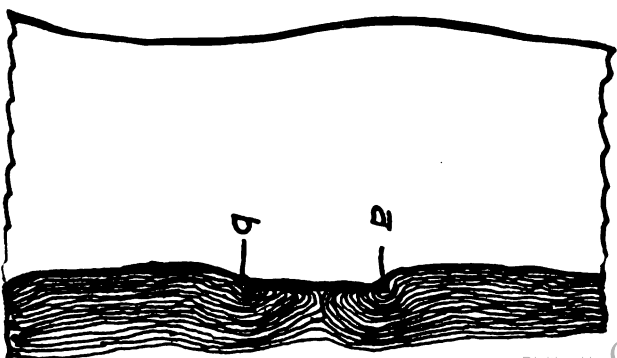
Showing proper method of cutting large limbs from trees
a. final cut; b. second cut; c. first cut.

FIG 3.



Improper method of pruning.
A. stub is left, and the wound does not heal.

FIG 4



Proper method of pruning. The wound
heals over. a-b cut surface.

The best time for pruning is in the late fall, winter or early spring, when the sap is not active, but small branches and branchlets may be removed at any season of the year without serious injury to the tree. It is a common practice to top maples and a more vicious process cannot be imagined. There is usually nothing more beautiful than the natural shape any tree assumes, although this may be advantageously modified to fit particular conditions; as for instance, when the shade is too dense or when the natural growth of the tree is a serious interference in some direction.

All limbs should be pruned flush with the trunk or the larger branch from which they spring. No short stubs should be left. The aim is to help the wound resulting from the pruning to heal over as rapidly as possible. If a limb is removed close to the trunk or main stem the bark rapidly grows over the cut surface and eventually covers the wound altogether. It must be remembered that every open wound offers a point of attack for insects and fungus diseases. This cannot be better explained than by diagrams. (See diagrams, figures 2, 3, 4, 5, 6, pages 58a, 59a, 60a).

If a large limb is not removed close to the main stem it should be pruned back to a small vigorous branch, so that the small branch may live and maintain the cambium layer in a healthy condition. A callous is then formed over the end of the limb removed. This is shown graphically in figure 6, page 60a.

If the limb of a tree is very large, it is advisable to cut it twice, once at a considerable distance from the main stem or trunk and finally close to the trunk as shown in figure 2. This prevents the bark from tearing from the trunk or branch. In some cases it may be necessary to make several cuts.

The tools which may be used in pruning trees are too numerous and too familiar to warrant description here. Preferably all cut surfaces should be painted over with a germicide such as heavy lead paint or tar to prevent the spores of destructive fungi from entering at this point.

TREE SURGERY.

Tree surgery is a term which has lately been applied specifically to the work of certain firms and individuals who make a specialty (or purport to do so) of the care and rejuvenation of shade trees. Undoubtedly, we should make every effort to care

for our tree friends since in many instances it is impossible to put a money value on them, and because of the length of time it takes to replace a tree which has been destroyed or dies naturally. The question of spending large amounts of money with those who specialize in this character of work is largely a matter of the individual purse. There is nothing especially new about tree surgery nor anything particularly secret about the methods employed. It is largely a matter of common sense, ingenuity and skill. There are a great many ways in which anyone who will may go a long way in preserving his trees. Cement has come widely into use of late years and this has suggested work on trees much on the same principle as dentistry. The decayed place is thoroughly cleaned out and all dead and infected material is removed. A germicide is then applied to the cleaned surface and the cavity filled with cement **so that the outer surface of the cement is flush with the inner surface of the bark.** The success of the operation depends upon the thoroughness with which the decayed portion of the tree is removed, the care with which the cement is prepared and the skill with which the filling is done. If the cavity is small the bark will grow out over the cement and ultimately cover it, or if the cavity is large the bark will partially cover the cement in such a way as to prevent subsequent decay. If the decayed portion of the tree is very large a system of braces should be inserted throughout the cavity to stiffen the cement and afford a mechanical support for the weakened tree trunk. The ingenuity of the individual will usually suggest the best character of bracing to secure the desired results.

One of the most frequent injuries from which trees suffer is splitting. By a little foresight this can often be prevented. A long iron bolt may be passed through the tree at the crotch and firmly tightened there. Good-sized washers should be used at either end of the bolt. Also shorter bolts may be inserted through the individual members of a crotch and fastened together with a chain. If this latter is done both bolts should have eyes at the inner end to which the chain may be fastened. (See Figure 7 p. 61a).

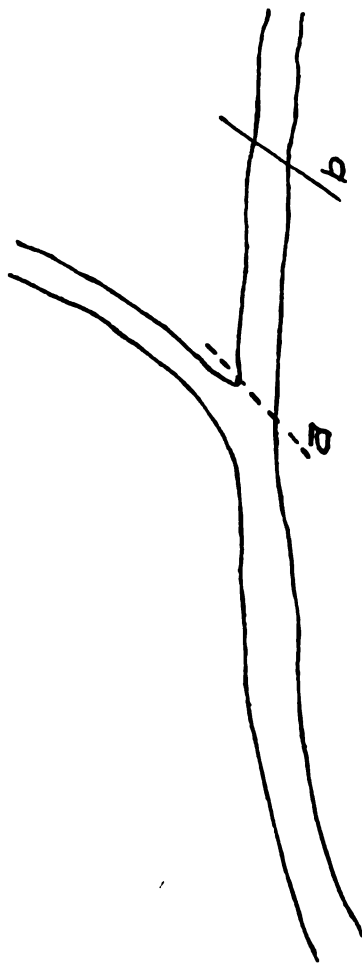
In the event the tree has been split the same remedial measures may be applied as have been indicated above, but the split surfaces should be freely treated with a germicide to prevent the introduction of fungus spores into the heart wood. Bands of wire, iron or other materials should never be placed around tree stem at any

FIG 5



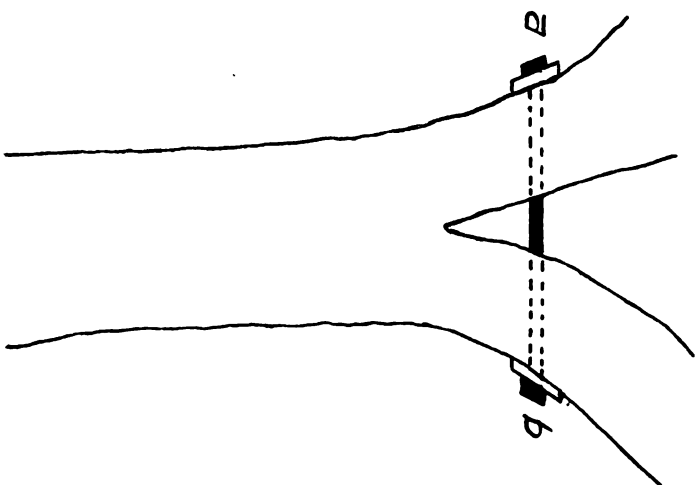
Section of trunk, showing decay, which results when long stubs are left after trimming and pruning.

FIG 6



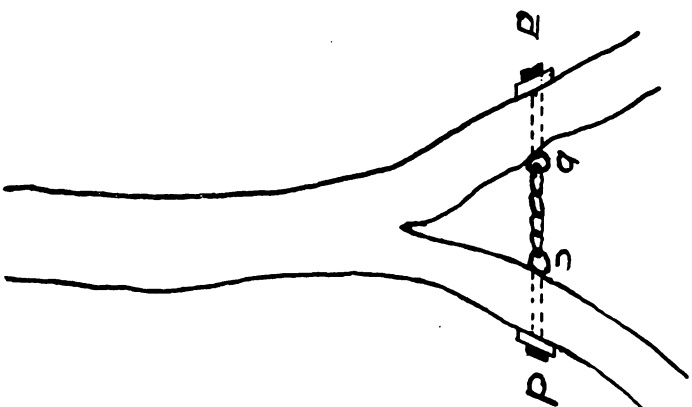
Showing method of pruning where all of a branch is not cut off.
 a. Proper place to remove limb—close to a living branch.
 b. Improper place. The portion a-b will decay and affect balance of limb.

FIG 7



Method of repairing a split trunk or
strengthening a fork in a tree trunk.
a-b iron bolt.

FIG. 8



Method of repairing a split trunk or
strengthening a fork in a tree trunk.
a, and c-d, iron bolts, b-c, steel chain.

point since they do not allow for the growth of the stem in diameter, do serious injury and ultimately kill the portion of the tree above and beyond the point where placed. Vines of a strong woody character have the same effect on a tree. It is no uncommon sight to see a tree killed by grape vines.

TREE DISEASES AND INJURIES.

This is an exceedingly broad subject and can be only briefly treated in a bulletin of a popular character such as this. Shade trees in cities, towns or villages, as has already been shown, are especially subject to various ills, for the simple reason that conditions which make for normal, healthy growth are being continually disturbed. In a city, for instance, when a sidewalk or pavement is laid, excavation is necessary and the root systems of the adjacent trees are very apt to be seriously interfered with and injured. Often a considerable portion of the root system is cut away. The fact that a pavement or sidewalk has been laid also means that normal moisture conditions have been greatly disturbed, since the rains do not soak through the pavements or sidewalks to the roots of the trees, but run off, and the root system gets a small percentage of the water which it has heretofore obtained and which it requires. The laying of water mains, gas mains, sewers, electric light, telephone and telegraph wire conduits is exceedingly prone to cause damage to the root system of shade trees. Changing grades often destroys trees entirely. Again, the ground along streets is apt to become impregnated with illuminating gas or sewer gas, which has a very deleterious effect on the roots of trees. It is impossible to guard against a great many of these injuries, and often only a careful study of the tree and the immediate surroundings will serve to disclose the cause of the trouble. When a considerable portion of the root system has been cut away by any public work the crown of the tree should be very decidedly reduced by pruning so that it may not be a burden on the ability of the root system to supply food. The presence of gas in the soil causes strangulation of the tree. If a large amount of gas is introduced into the soil within a short space of time in the vicinity of tree it will die at once; if the gas is introduced into the soil slowly and in small quantities the tree will die gradually unless preventive measures are taken. The leaves usually turn brown at the edges, present a pale and sickly appearance and gradually dry out and

die. The remedy from this condition is to supply new dirt and, if possible, to discover the gas leak and stop it. Gases in the air often destroy trees. Trees continually exposed to smoke from locomotives are very apt to die. Fumes of sulphur dioxide from smelters and furnaces will kill trees for great distances around. In the vicinity of Butte and Anaconda, Mont., there is not a living tree within a radius of several miles. The same is true in the vicinity of Ducktown, Tenn. Generally speaking, a tree growing under perfectly normal conditions, which has not been subjected to injuries of any sort, is not subject to diseases or insect attacks. It has been shown in cases of great insect infestations that the insects first attack diseased trees or trees the vitality of which have been reduced because of various causes. Also a tree which is physically perfect does not offer points of attack for fungus diseases. The point is that trees are rarely physically perfect or have normal vitality, since they are continually subjected to various destructive agencies, and after maturity combat these much less effectively. Winds, storms of hail and sleet, lightning, frost and fire are some of the natural agencies which do serious damage to trees, causing wounds which afford points of attack on the health of the tree by insects and fungi. The process of natural pruning, which results because of the shading out of the lower limbs on the tree, may have the same effect as any other character of injury, especially if the limbs persist on the tree for any length of time after they become dead. Such limbs should be removed, preferably even before they die.

When a tree is wounded from any cause it is the part of wisdom to paint the injured surface over at once with a germicide. When fungi attack a tree at any point the diseased portion should first be cut away and then a fungicide applied either by spraying or painting it on. The most satisfactory and generally used of these is the Bordeaux mixture, which may be prepared as follows:

“5 lbs. copper sulphate (Cu SO_4) dissolved in hot water;
5 lbs. fresh quicklime, freshly and slowly slaked.”

The quicklime should be passed through a fine mesh strainer and diluted by adding a gallon of water. It must be in the form of a creamy liquid, free from grit. The two liquid mixtures are now diluted with 24 gallons of water each and slowly mixed by pouring simultaneously into a 50-gallon cask (no metal vessels can

be used). In dealing with fungus diseases "an ounce of prevention is worth a pound of cure."

The insect enemies of trees have increased enormously of late years and in some sections of the United States have become so bad that the most vigorous measures have been taken to combat them. The gypsy and brown-tailed moths in New England have threatened to exterminate certain species of shade and forest trees, notably the elm. Roughly the classes of insects may be divided into boring insects, sucking insects and biting insects. In the life history of insects there are four distinct stages: (1) the egg stage; (2) the larva or grub stage; (3) the cocoon or dormant stage; (4) the moth or beetle stage. To cope successfully with any of the three classes of insects cited above it is usually necessary to destroy either the eggs or the larvae.

Biting Insects—These are those which attack and devour the leaves of a tree and can only be successfully combated by spraying. It is no easy proposition to spray a shade tree of any size effectively, since the insecticide must be applied thoroughly and completely to the tree so as to reach all portions affected. The insecticide should, therefore, be applied with considerable force to the side of the leaf attacked, usually the under side. It is possible to do this in cities, towns and villages by the ownership of a power spraying apparatus, of which there are excellent varieties on the market. Any community can get together and purchase one of these outfits, but the private individual of small means is up against a hard proposition in dealing with insect pests on large shade trees. Only the most careful and painstaking work with an ordinary spraying apparatus will suffice. The best spraying mixtures to use are paris green or arsenate of lead.

Some insects lay their eggs in refuse on the ground, on stone walls, on fences, etc. The refuse on the ground should be collected and burned in case of an infestation; also adjacent stone walls and fences should be inspected for eggs. In the case of other insects the eggs are laid and hatched on the ground. This is the case with the elm-leaf beetle; the caterpillar must crawl up the trunk of the tree to get at the leaves. A band of cotton batting, sticky fly paper or like material will prevent the caterpillar from going up the tree. They can then be gathered up at intervals and destroyed.

Sometimes in the cocoon stage certain insects form very conspicuous nests, as is the case with the fall web worm. These should be removed from the tree and destroyed.

Sucking Insects—These are the bark lice and scales, which may be treated by spraying with kerosene emulsion, or a solution of tobacco or lime and sulphur may be used. In the case of young trees care should be taken not to saturate the ground with the kerosene emulsion, else the roots may be smothered.

Boring Insects—Among the boring insects may be included the round and flat-headed borers, the bark beetles, etc. They rarely attack a tree except when it is in a weak condition or when the vitality has been greatly lowered. They are hard to deal with since they work wholly within the tree. If a tree is very badly infested by borers, the best thing to do is to cut the tree down and burn it entirely to prevent the spread of the insects. Occasionally the eggs of this class of insect are laid in the bark, where they may be destroyed by spraying with kerosene emulsion. The presence of borers is indicated by small piles of sawdust in the bark. Occasionally it is worth while to inject carbon bisulphide into the holes and seal them up with wax, soap or a similar material so that the insect is destroyed.

TREES TO PLANT.

No attempt is made here to give all the silvicultural characteristics or the dendrological features of all the tree, but only such points have been touched upon as affect the value of particular species for a shade or ornamental tree, and only such trees are discussed as are commonly used for shade trees or may be so used advantageously in Kentucky. Generally speaking, shade trees should be confined to native tree species. In the case of ornamental lawn trees, the taste and desires of the owner will largely prevail. In the following list of trees relatively few trees not native to Kentucky have been included and described. In the consideration of trees for shade and ornamental purposes there are several features which are of especial importance, among them (1) ornamental value (including autumn foliage, flowers, fruit, etc.); (2) shade value; (3) soil and moisture requirements; (4) size and shape; (5) rate of growth; (6) liability to mechanical damage, insects and disease; (7) cleanliness of habit; (8) resistance to artificial conditions of city and town.



HEMLOCK—TSUGA CANADENSIS.

1. White Pine—*Pinus strobus*.

This pine is a native of Kentucky, but is confined in commercial quantities to the eastern mountain region. It has been planted extensively over the entire State since it is one of the largest, most graceful and generally adaptable trees for ornamental planting. The needles are of a dark blue-green color, long and slender, and occur in bundles of five in tufts at the ends of the branches, so that the tree is unusually attractive. The whorled arrangement of the branches also adds to the attractiveness of the tree. The white pine attains a height of 120 feet and occasionally more, but in this State it is commonly much smaller. It is easily transplanted, and in this region apparently not subject to serious insect attacks. The crowns of old trees assume a flat form, which gives a very pleasing landscape effect. Suitable for parks and large lawns, thrives in soils of medium quality, particularly sandy soils; needs considerable moisture. Does well, however, in soils of poor quality. A rapid

2. Hemlock—*Tsuga canadensis*.

Hemlock is also a native of the mountains of Eastern Kentucky, and, like the white pine, has been generally planted throughout the State as an ornamental tree. Single specimens attain a height of 75 feet and more, but the tree where used horticulturally is commonly smaller. The branches are long, graceful and pendulous, and the needles are vividly green, shiny on the upper surface. Thrives best in shady situations and requires plenty of moisture. Grows well in many soils, but likes best a moist clay. Can be used for hedges and close effects. A noticeable feature of the hemlock which distinguishes it from other conifers is the graceful, plume-like droop of the leader. Very much subject to fungus diseases and adversely affected by artificial city conditions.

3. Bald Cypress—*Taxodium distichum*.

(Other common names, Cypress, Swamp Cypress.)

This tree is found as a native of Kentucky only very locally in the swamps and bottom lands of the Ohio and Mississippi rivers in the western part of the State. It has been sparingly planted for ornamental purposes in various sections, but when removed from its natural exceedingly moist habitat the species takes on a slender form and does not attain any great size. This tree is one

of the few conifers which shed their leaves in the fall. The foliage is a light yellow green and the branches are slender, giving the tree a feathery appearance. The form of the trunk and branches is distinctly spire shaped. Needs a rich moist soil. Is not available for extensive ornamental work. Is cleanly of habit and not subject to insect or fungus attacks.

4. Red Cedar—*Juniperus virginiana*.

(Other common names—Cedar, Juniper.)

Red cedar is distributed throughout Kentucky and is of value for ornamental planting in parks or lawns, especially where formal effects are desired. The species grows slowly, is not particular as to soil or climate requirements, is tolerant of shade, and is long-lived. In its early life the tree is conical in form, but with age loses this distinctive characteristic to a large extent and the crown becomes scraggly, less formal and vastly more picturesque. The foliage is of a dark blue-green tinge during the summer, but takes on a reddish-brown tinge during the winter months. The fruit or "berries" are a dark blue covered with a bloom and are an attractive feature of the tree. Red cedar is not subject to insect attacks, but is the host of a variety of fungi, the most serious among which is the "cedar apple," which during one stage of its life history appears as a "rust" on the leaves and twigs of apple trees.

5. Ginkgo—*Ginkgo biloba*.

(Other common names, Maidenhair Tree.)

This tree is not a native of Kentucky nor of the United States. Its home was originally in North China and the species was introduced into the United States from Japan and from England, where it had been brought from Japan. The tree where it has been planted in Kentucky is hardy and grows to a great size. Specimens in Frankfort are fully 75 feet tall. The peculiar feature of the tree is the leaves, which are fan-shaped, with two distinct lobes, resembling in an astonishing degree the leaves of the maidenhair fern. Although the species is a conifer, it sheds its leaves in autumn. The foliage turns a deep yellow with the approach of winter and falls, not gradually, but altogether within a comparatively short space of time. The tree makes an excellent shade tree, both for street and park planting, since it suffers from neither in-



RED CEDAR—JUNIPERUS VIRGINIANA.
(Old specimens)



GINKGO—GINGKO BILOBA
and PURPLE BEECH—FAGUS SYLVATICA PURPUREA.
(The tall tree in the center is the Ginkgo and is a fine specimen. The purple
beech is crowding it.)

sects or fungi. Early in life the ginkgo has a spire-like form, but later assumes an irregular crown. It grows reasonably rapidly in Kentucky, especially in the central and western portions of the State, does not seem to be overly particular as to soil requirements, and is cleanly of habit. All in all it is a particularly satisfactory tree to plant, but does not furnish dense shade. This is the oldest known tree species geologically.

6. Cottonwood—*Populus deltoides*.

Cottonwood is fairly widely distributed in Kentucky. It grows naturally in most situations along streams, but does excellent in much drier situations. The growth of the species is very rapid; it is easily transplanted and will stand a great deal of abuse and smoke. Individual trees attain a large size. The trunk divides into large branches at a height of twenty feet or more from the ground, forming large spreading crowns. The foliage is a bright green in summer and turns a dull yellow in the autumn. The leaves are produced early in the spring and remain on the tree far into the fall. The tree has been extensively planted for shade and ornamental purposes, especially in the Middle and Far West, because of its exceedingly quick growth. It has several bad habits as a shade tree in a city or town. The seeds are distributed by means of a feathery, cotton-like appendage, which blows all over, even within the houses. This is very objectionable. The limbs of the older trees are easily broken by the wind and the species is short-lived. The roots on their search for water often get into sewers and drains and interfere seriously with the purposes of these. This is, however, the best of the poplars to plant.

7. Swamp Cottonwood—*Populus heterophylla*.

(Other common names, Black Cottonwood, Downy Poplar.)

General characteristics much the same as the cottonwood (*Populus deltoides*). Foliage turns a dull yellow in fall. Not so available for general planting purposes as the foregoing. Leaves do not tremble to the extent that the leaves of other species of this genus do.

8. Large-Toothed Aspen—*Populus grandidenta*.

General characteristics much the same as the cottonwood (*Populus deltoides*). Leaves turn a clear bright yellow in autumn.

9. Lombardy Poplar—*Populus lombardiensis*.

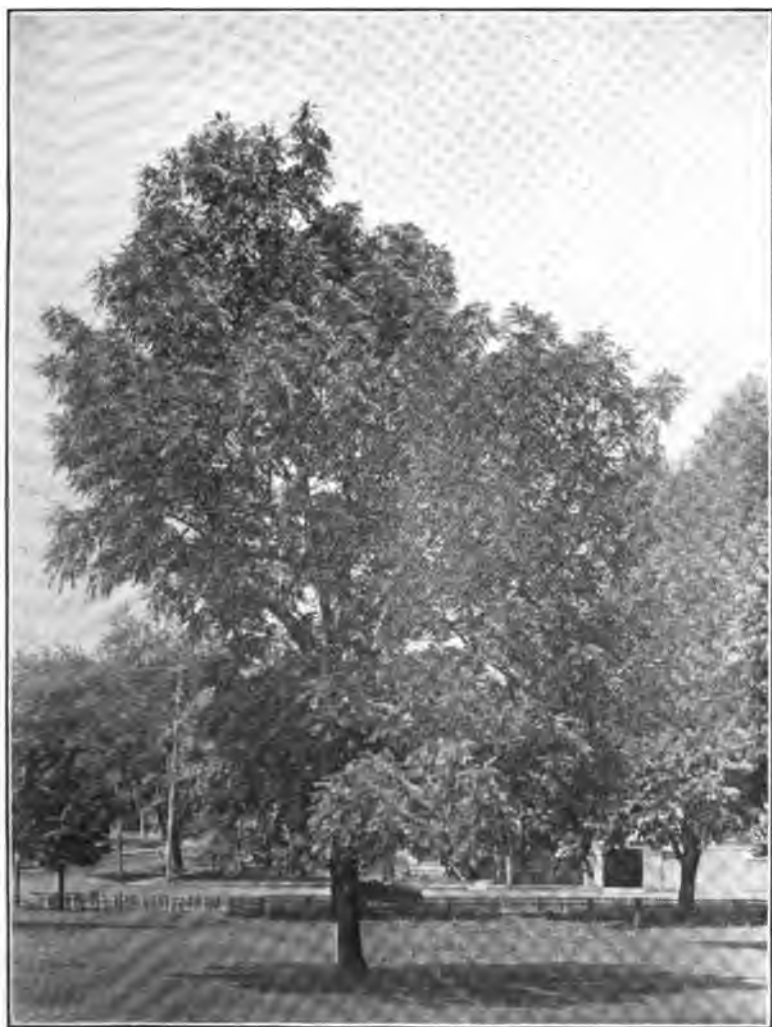
This tree is not a native to America, but was the first tree introduced into the United States. It has several features which make it a desirable tree for ornamental purposes, although it is not of large value as a shade tree. The species has a pronounced spire-shape crown, which begins at a short distance from the ground. The branches are generally slender, hug the trunk and grow in an upright position. The tree is not especially particular as to soil, moisture or climatic requirements. Lombardy poplar is especially available for formal effects. It can be used with excellent effect to line long straight driveways and roads since an attractive vista is formed. It can also be advantageously used along walls or any place where it is desirable to emphasize straight lines. The tree is not long lived and grows to a height of sixty feet, more or less. The foliage takes on a deep yellow tint in the fall.

10. Weeping Willow—*Salix babylonica*.

This is another exotic species, but one early introduced in the United States. It has a distinct ornamental value because of its long pendulous branches. It grows well along waterways and in moist situations and is particularly effective around small lakes and ponds and along canals in parks. It grows very rapidly and becomes a very large tree. The branches are brittle and break off very easily. It is propagated most easily from cuttings.

11. Walnut—*Juglans nigra*.

This species was formerly well distributed throughout the whole Mississippi valley and has been one of the most valuable components of the Kentucky forest. It grows to be a large tree, a hundred feet or over in height, and is long-lived. It demands a very rich soil for its best development and with that grows rapidly. It has been used extensively in plantations throughout the State. Walnut has thick prominent branches and is not a graceful tree in winter. The foliage is thin, appears late in the spring, and falls early in autumn. While the tree is not subject to insect or fungi attacks, the leaves suffer greatly from insects. The nuts are highly prized, but this is a disadvantage where the tree is used as an ornamental or shade tree, because of the small boys who desire the nuts and injure the trees by climbing and in other ways. The tree appears to best advantage when planted singly. It is intolerant of shade.



BLACK WALNUT—JUGLAUS NIGRA.

12. Butternut—*Juglans cinerea*.

(Other common name, White Walnut.)

This tree has the same general characteristics as the walnut. It will grow on poorer soils and in wetter situations, is not so large a tree, and is relatively short-lived.

The Hickories.**13. Shagbark Hickory—*Hicoria ovata*.**

(Other common names, Shellbark, Scalybark.)

The shagbark is one of the best known of the hickories in Kentucky because of its wide distribution and because the nuts are so universally prized as a food. The shagbark when grown in a dense forest has a tall slender trunk and a small crown, and attains to a considerable height (from one hundred feet up). When grown in the open the crown is much larger and extends down the main shaft close to the ground and the tree has a decided tendency to fork within the crown into two or three main stems. The bark of the tree is distinctive since it becomes loose on the trunk in long strips, giving the tree a shaggy appearance. The shagbark grows naturally on the lower slopes of hills and especially in limestone soils and river bottoms, but will do well in soils of relatively poor quality. The foliage is coarse and the tree does not furnish much shade. From this fact it is a valuable ornamental tree on lawns and in parks where it is desired to have a good growth of grass. The nuts are a bad feature from the fact that they are eagerly sought after by man. This tree should not be planted along streets. The leaves, as with all hickories, turn a clear yellow in the fall.

14. Black Hickory—*Hicoria glabra*.

(Other common names, Tight Bark, Switch Bark.)

This tree has the same general characteristics as the preceding. It is a smaller tree and the bark becomes only slightly flakey with age. It grows under a wide range of conditions of soil and climate.

15. Mockernut Hickory—*Hicoria alba*.

(Other common names, Big Bud and White Hickory.)

This species is usually a smaller tree than either of the two foregoing. The stem is less likely to be straight, the branches are heavier, while the leaves and twigs are coarse and heavy.

16. Bitternut—*Hicoria minima*.

(Other common names, Pignut, Willow Hickory.)

The bitternut has the same general characteristics as the other hickories. The branches are slender and the foliage is dark green and shiny on the upper side. The tree is tall and slender and grows fairly rapidly, so that it is, perhaps, the most available of the hickories from a horticultural standpoint.

17. Hop Hornbeam—*Ostrya virginiana*.

(Other common name, Ironwood.)

A common tree in Kentucky woods. Grows in dry situations and usually in the shade of the larger trees. Ordinarily a small, slender tree, but occasionally attains great size. The bark and branching resembles the beech, the leaves resemble the birch, while the fruit resembles most remarkably the fruit of the hop vine.

18. American Hornbeam—*Carpinus caroliniana*.

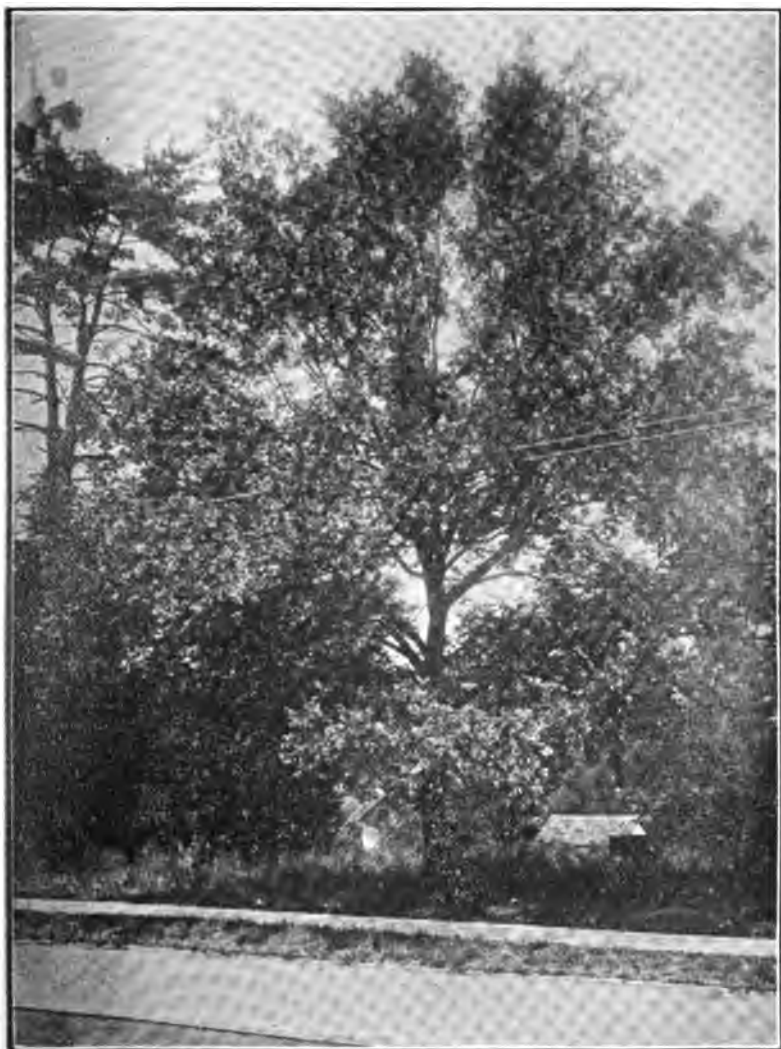
(Other common names, Ironwood, Blue Beech, Water Beech.)

This species is common in Kentucky along water courses and in moist situations. It is usually a small tree. The bark resembles the beech, while the leaves resemble more the elm. It is peculiar in this, that the sinews of the branches appear to run down the trunk, as in the beech. The branching habit of the tree is irregular, while the branches are long, crooked and often pendulous, so that the tree is very ornamental in lawns and parks and is available in very moist and shady situations. The autumn foliage is brilliant, taking on red, scarlet and orange hues.

19. Black Birch—*Betula lenta*.

(Other common names, Cherry Birch, Sweet Birch, Mahogany Birch.)

This tree is found most abundantly in Eastern Kentucky, but occurs sparingly in the western portion of the State. It is a beautiful tree, attaining ordinarily a height of 75 feet and more. The outer bark of the younger tree resembles the domestic cherry very closely, while the inner bark is spicy and aromatic. The foliage is a dark green above and a pale green below. The branches are often pendulous and add to the attractiveness of the tree from an ornamental standpoint. One of the attractive features are the panicles of golden yellow catkins in the spring. The black birch



PECAN (HICKORY)—HICORIA PECAN.



(In full bloom)
CHESTNUT—CASTANEA DENTATA

should be planted in moist situations. The crown is well rounded. The foliage turns yellow in the fall. Suitable for planting in parks and on lawns.

20. American Beech—*Fagus atropunicea*.

The beech is one of the widely distributed trees of Kentucky and is exceedingly beautiful from a horticultural standpoint. It is a large tree. In the forest it grows to a great height and has a small narrow head; but in the open the crown starts close to the ground and is large and spreading and affords a dense shade. The branches are slender and graceful, while the leaves in summer are dark green, almost paper-like in texture. In autumn the foliage turns a dark brown, gradually bleaches out to a whitish brown and persists far into the winter and the following spring. The tree is very tolerant of shade and requires a moist situation with a deep rich, loamy soil for its best development; but will grow well in drier situations and other soils, especially limestone soils. The beech is rather hard to transplant, the larger the hole dug for its reception and the more care used in the setting of it out, the greater are the chances of its living and doing well. The bark of the tree is smooth, has a mottled grayish appearance, so that the tree in winter is very pleasing. The beech is not subject to insects, but when young liable to frost and sun scald and in old age subject to fungus disease.

21. European Beech—*Fagus sylvatica*.

The European beech resembles the American species very closely. The bark is paler in color and the foliage is a lighter green. The tree is less hardy, but leaves out earlier in the spring. A variety, purple beech (*Fagus sylvatica purpurea*) is more extensively used for ornamental purposes because of the coloring of its foliage, which is a brilliant copper red in the spring when the leaves come out and becomes a darker purplish red later in the season.

22. Chestnut—*Castanea dentata*.

This species is found pretty generally distributed in Kentucky, except on limestone soils. It occurs most abundantly in the mountain regions at elevations exceeding 1,200 feet. Is a large tree usually, but when grown in the open it develops a wide spreading crown and does not grow so tall. Within its natural range

it lives to be of great age. The leaves are a dark green on the upper side with considerable gloss, but are paler green underneath. The long catkins of flowers which appear in June are an attractive feature. The tree thrives best on well-drained soils and needs plenty of room for its best development. It is suitable for parks and lawns. The color of the autumn foliage is a bright yellow. A very serious fungus disease has attacked this species in the East and threatened to exterminate the species in certain localities. It has not, as yet, been noted as doing any considerable damage in Kentucky, but the possibility of the spread of this disease should make one hesitate before planting it.

23. Chinquapin—*Castanea pumila*.

This tree occurs throughout the State, but chiefly in the south-central part and in the mountains. It is either a shrub or a small tree. The leaf is smaller than that of the chestnut, is downy on the under surface, so that it has a silvery appearance. This species is valuable for ornamental purposes.

The Oaks.

24. White Oak—*Quercus alba*.

The white oak is common everywhere in Kentucky and has been one of the most valuable timber trees within the State. It grows to a large size, being commonly 100 feet in height and 4 feet in diameter. The white oak is adaptable to many situations and soils. It does not, however, grow naturally in poorly drained or swampy situations. Like most of the oaks, the white oak grows slowly, but it is a very long-lived tree. It is a fine tree for ornamental purposes. The crown develops into a naturally beautiful form. The branching habit is attractive. The foliage in spring is a very pale green tinted with pink. In the summer the leaves are a light yellowish green, while in autumn they turn a deep red and the general appearance is very attractive. The shape of the leaves is in itself pleasing. The tree is not subject to fungus disease, but suffers from the gypsy and brown-tailed moths in some sections, although not as yet to any marked degree in Kentucky. This tree could with advantage be used for streets more extensively than it is at the present time. In this respect its slowness of growth does not commend it favorably, it seems.



WHITE OAK—QUERCUSALBA.



BURR OAK—QUERCUS MACROCARPA.

25. Burr Oak—*Quercus macrocarpa*.

(Other common name, Mossy Cup Oak.)

The burr oak is a very large tree and is noticeable for its wide spreading cork-ridged branches. In general characteristics it resembles the white oak. The acorns have deep mossy cups and the leaves are beautifully and deeply lobed. It thrives best in moist situations and is excellent for large spaces in parks or on lawns on account of its widely spreading habit.

26. Post Oak—*Quercus minor*.

Same general characteristics as white oak. Will grow in dry sandy soil or on gravelly uplands. Foliage turns yellow or brown in the fall.

27. Chinquapin Oak—*Quercus acuminata*.

A large tree. Grows on limestone ridges. Attractive foliage, which in autumn turns orange yellow or scarlet. A good tree for large lawns and parks.

28. Basket Oak—*Quercus michauxii*.

(Other common name, Cow Oak.)

A large round-headed tree with handsome foliage. Prefers moist situations. It is strongly recommended for planting.

29. Red Oak—*Quercus rubra*.

This is the most rapid-growing of the oaks, is adapted to a wide range of soils and is easy to handle and plant. It is a large tree with a broad symmetrical crown. The foliage in summer is a deep glossy green, turning a rich red in autumn. This is one of the best oaks for street planting because of its symmetry of form, pleasing foliage and dense shade.

30. Black Oak—*Quercus velutina*.

(Other common name, Yellow Oak.)

A common tree in Kentucky, reaching a height of 75 feet. Grows naturally in gravelly clay soils of slopes and ridges, but grows well in most soils. The leaves are a dark glossy green above and yellowish brown underneath. Makes a beautiful shade tree.

31. Scarlet Oak—*Quercus coccinea*.

Scarlet oak is a valuable and beautiful tree for streets, lawns or parks. Resembles in general the black or red oak. The leaves turn a bright scarlet in the fall. The leaves are very finely cut and in summer are dark green.

32. Texan Oak—*Quercus texana*.

Resembles the foregoing species very closely, but demands moist situations.

33. Pin Oak—*Quercus palustris*.

Is a rapidly growing species, easily transplanted. Forms a symmetrical crown. Is an excellent tree for street planting and has of late been very extensively used. The foliage is a pale green in the spring, turns a dark green in summer and in fall becomes a rich scarlet. This tree is strongly recommended.

34. Spanish Oak—*Quercus digitata*.

The leaves are unique and have a pleasing variety of form. Foliage turns yellow in the autumn. Makes a good tree for planting on streets or lawns or in parks. Is a fairly large tree.

35. Shingle Oak—*Quercus imbricaria*.

A rather small tree. The leaves are a dark shiny green and are long and narrow, sometimes three-lobed. Tree grows in moist situations. Deserves planting for ornamental purposes.

36. Willow Oak—*Quercus phellos*.

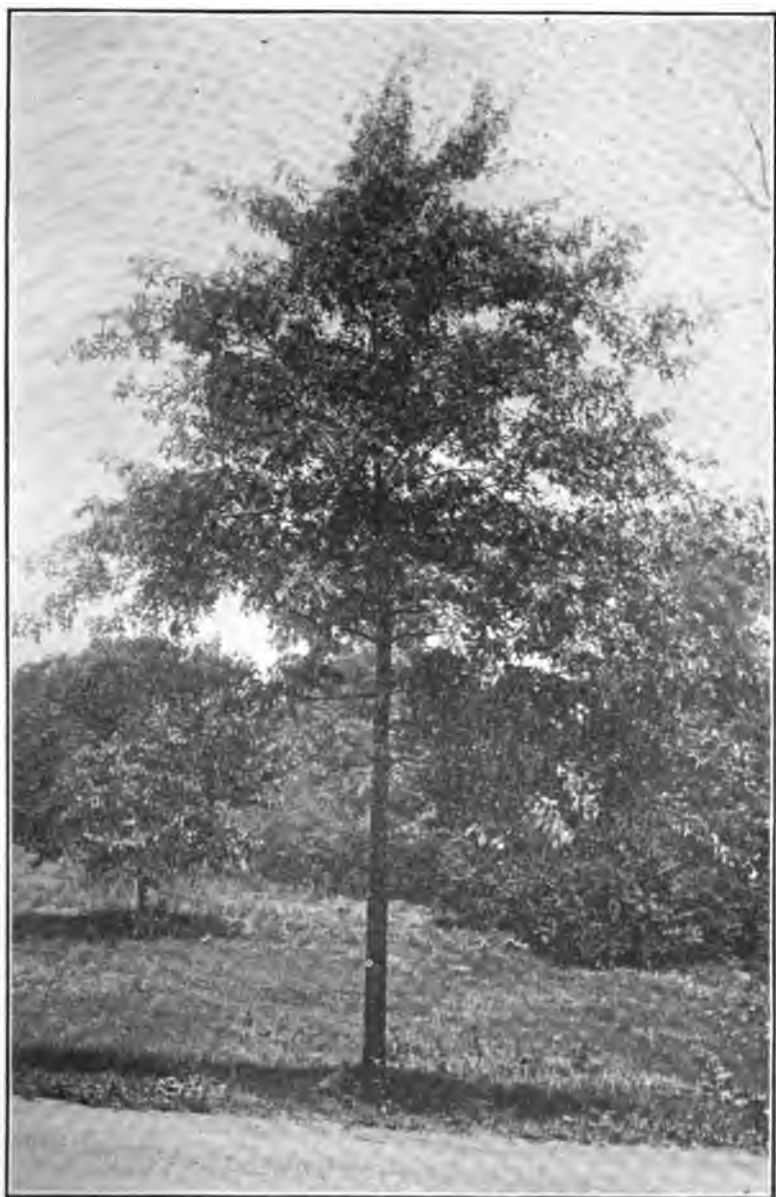
The leaves of this oak resemble the willow, and the species is named because of this fact. It resembles the shingle oak. Demands a moist situation and makes a good shade tree in the South.

37. Laurel Oak—*Quercus laurifolia*.

Resembles both the foregoing species. It is a handsome tree and is adaptable to lawn or street planting, especially in the southern towns,



CHINQUAPIN OAK—*QUERCUS ACUMINATA*.



(Small tree)
PIN OAK—QUERCUS PALUSTRIS.

The Elms.**38. White Elm—*Ulmus americana*.**

(Other common name, American Elm.)

The white elm is one of the commonest and most popular of American shade trees, and deservedly so, since it is naturally the most graceful of the forest trees and is exceedingly beautiful in its general lines. It is a large tree, often 100 feet tall, and its crown spreads to great distances. The trunk divides into several main stems, which give it the appearance of an inverted cone or pyramid. The branches are long and slender, with a tendency to droop. The tree grows fairly rapidly and lives to a considerable age. The foliage is a dark above and a light green below, and turns to a yellow or brown in the autumn. This is an excellent tree for shade purposes, either along streets, on lawns or in parks, although over certain sections of the country elm has been badly infested by various insects, which have rendered it almost valueless. This is not, however, true of Kentucky. Spraying will kill these leaf-destroying pests.

39. Slippery Elm—*Ulmus pubescens*.

(Other common name, Red Elm.)

The slippery elm resembles the white elm very closely in its several characteristics and is available for planting in the same situations.

40. Rock Elm—*Ulmus racemosa*.

(Other common name, Cork Elm.)

The rock elm resembles the two preceding species, but is especially adapted to gravelly uplands, rocky slopes and cliffs. The branches are peculiar because of the irregular corky ridges, while the foliage has a smooth deep green color.

41. Hackberry—*Celtis occidentalis*.

(Other common name, Nettle Tree.)

The hackberry resembles the elms very closely. It is a medium-sized tree, grows generally throughout the State. The bark is covered by warty excrescences. The fruit is a dark blue or purplish berry. The foliage is very like the leaves of the elm. This tree makes a rapid growth, is not particular as to soil and is

not subject to insects or disease to any extent. It is a species which is available for planting along streets or lawns or in parks and should be so used more extensively than it is at present.

42. Mulberry—*Morus rubra*.

(Other common name, Red Mulberry.)

The red mulberry is extensively distributed throughout the State. It is a medium-sized tree, usually branches low and has a wide spreading crown. It grows rapidly and affords a dense shade. The leaves are not constant in form and are blue-green in color. It is free from disease and the attacks of insects, lives to a great age and is a valuable ornamental tree. The berries turn a dark red at first, then a purplish black, and are a delight to birds, but make a very objectionable litter on the ground. The foliage turns yellow in the fall. The tree transplants easily.

43. Osage Orange—*Toxylon pomiferum*.

The osage orange is usually a small tree growing naturally in moist rich soils, but is very adaptable. The leaves are a light yellow-green and the surface is smooth and shining. This tree has been widely used for hedges, but can be used more extensively as an ornamental tree than it is, since it is practically free from insects and fungus diseases and does not mind smoke.

44. Tulip Tree—*Liriodendron tulipifera*.

(Other common names, Tulip Poplar, Yellow Poplar.)

The tulip tree is known as the Kentucky State Tree because of its abundance throughout the State at one time. The species has been so extensively cut that it is becoming a scarcity in Kentucky woods. It is one of the most beautiful trees of the State. In the open it is a medium-sized tree with a rather regular habit of branching, so that a large conical crown is formed. The foliage is unique in shape and light green in color. The leaves flutter like the aspen, hence the name poplar. The foliage turns a bright golden yellow in the fall. The tree grows rapidly, and, while it does best on a rich loam soil, will grow fairly well on poorer soils. The flowers are an attractive feature. They are tulip-shaped, of a bright yellowish-green color smeared with orange at the base of the petals. This is a most excellent tree for ornamental and shade purposes along streets or in other situations. It is remarkably free



HACKBERRY—*CELTIS OCCIDENTALIS*.
(The dead limb in the top was caused by a guy-wire being
wound tightly around the branch)



TULIP TREES—*LINODENDRON TULIPIFERA*.
(Yellow poplar of commerce)

from disease and insects, nor is it seriously injured by smoke, and these features, together with its rapid habit of growth, recommend it very strongly for street planting. It is hard to transplant when large and should invariably be planted in the spring.

The Magnolias.

45. Cucumber Tree—*Magnolia acuminata*.

The cucumber tree has a good many of the habits of growth of the tulip tree. In the forest it develops a straight deeply-furrowed trunk which resembles remarkably a fluted column, but in the open the branches begin close to the ground and the crown is of a generally conical form. The leaves are a light shiny green and cluster close to the ends of the branches. They turn yellow in autumn. The tree is usually large and prefers a rich well-drained soil, but does well in poorer soils. An attractive feature is the fruit, which in the early stages is green and shaped like a cucumber. This fruit turns pink when ripe, and the red berries break out of the enclosing envelope and hang for a time by a thin thread-like structure. Each red berry encloses a black seed. The flowers are nearly the color of the foliage, and consequently very inconspicuous.

46. Umbrella Tree—*Magnolia tripetala*.

(Other common names, Elkwood and Cucumber.)

This magnolia occurs naturally in the mountain region of Kentucky, but has been extensively planted throughout the State because of the beauty of its leaves and flowers. It is an excellent ornamental tree for parks and lawns. The leaves are large and occur in whorls at the ends of the branches, suggesting an umbrella. The blossoms are large, creamy white in color, often tinged with pink or rose. The odor of the flowers is heavy and usually termed disagreeable. The umbrella magnolia is usually a small tree, often a shrub.

47. Ear-Leaved Magnolia—*Magnolia Fraseri*.

This tree is similar to the umbrella tree in its general characteristics. The leaves are large, dark green above, with ear-like lobes at the base. The flowers are large, white or cream white in

color and fragrant. The tree is small and often in cultivation a shrub.

48. Large-Leaved Magnolia—*Magnolia macrophylla*.

This tree is similar to the two foregoing. The flowers are very large, fragrant, creamy white in color, the petals purple or rose-colored within. The flowers and the enormous leaves (often two feet long) make this a conspicuous tree for ornamental planting.

49. Evergreen Magnolia—*Magnolia foetida*.

This species is not native to Kentucky, but is so extensively planted for ornamental purposes that it deserves mention. It is a tree of the Gulf States naturally. In this latitude it does not attain great size. The leaves are thick, leathery, shiny dark green in color on the upper side and a rusty brown on the lower side. They persist throughout the winter. The flowers are very large, white or creamy white and heavily fragrant. Often the odor of a single flower in a room is overpowering.

50. Pawpaw—*Asimina triloba*.

The pawpaw is a small tree, often (and especially in cultivation) a shrub. The leaves are large and usually are borne in clusters at the ends of the branches. They are dark green in color above and lighter green underneath. The tree prefers the shade and is most serviceable for ornamental purposes when planted in groups.

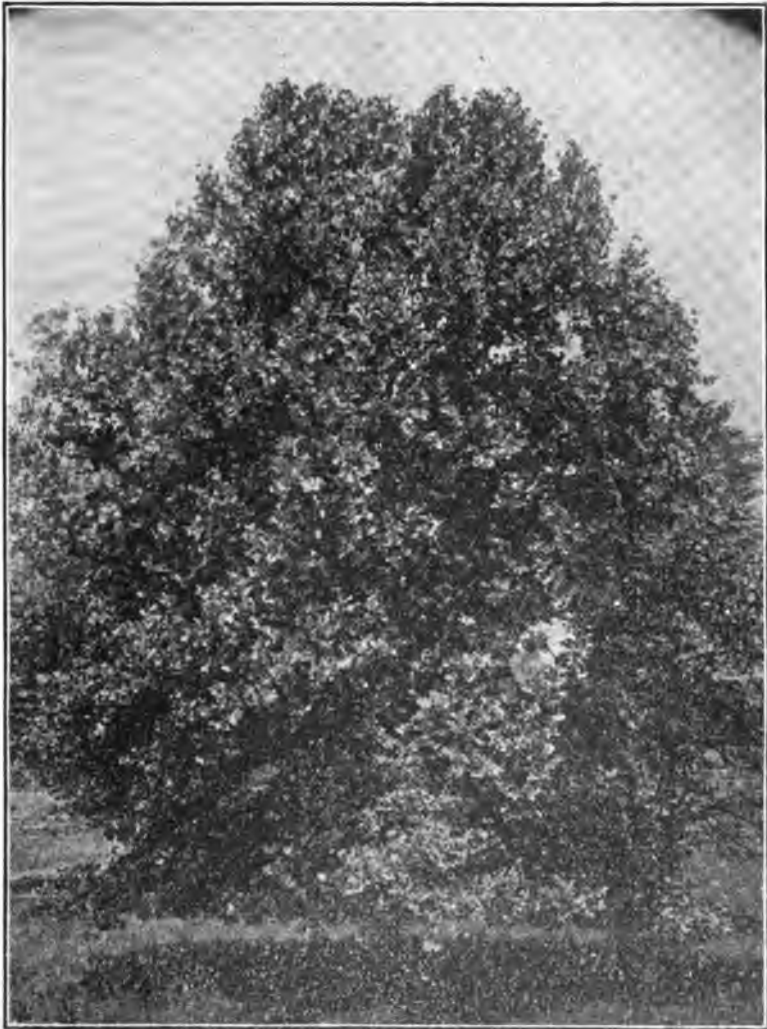
51. Sweet Gum—*Liquidambar styraciflua*.

(Other common name, Red Gum.)

The sweet gum occurs throughout the State. It prefers a rich moist soil, but is adaptable in this regard. It is a beautiful tree of large dimensions. It grows rapidly, attains a pleasing symmetrical form and lives to be very old. The foliage is star shaped and in fall turns a bright yellow and a variety of shades of red and purple, so that the autumnal appearance of the tree is very attractive. The bark has corky ridges, which are conspicuous even on the branches. This tree is an excellent shade tree for streets, lawns or parks and should be extensively planted. It is free from insects and fungus diseases and easily transplanted because of its shallow root system.



(Note vase-like form)
WHITE ELM—*ELLMUS AMERICANA*.



SYCAMORE—PLATANUS OCCIDENTALIS.

52. Sycamore—*Platanus occidentalis*.

(Other common name, Button Ball.)

The sycamore is one of the widely distributed trees of Kentucky. It is a very large tree, usually dividing into several main stems at no great distance from the ground. The habit of branching is exceedingly irregular. The most conspicuous feature of this tree is the bark, which exfoliates or "peels off," even on the smallest branches, so that the outer surface of the trunk and limbs are smooth and, except on very old trees, a grayish-white or white and green in color, while the smaller branches are often a snow white. This feature makes it conspicuous at all times, and especially in winter. The tree grows naturally in rich soils, along streams or in other moist situations, but will do well where less moisture exists. The leaves are distinctive in outline and of a light green color. They turn brown in the fall. It grows rapidly and luxuriantly and is extensively used for shade along streets or on lawns and in parks. Usually the sycamore is long-lived, although it is subject to butt rot and fungus disease, which attacks the leaves and causes them to drop early in the spring.

53. Wild Black Cherry—*Prunus serotina*.

The wild black cherry is usually a medium-sized tree, with slender pendulous branches and a regular oblong crown. The tree grows rapidly on good soil and lives to be very old. It will do well on poor soils with little moisture. It is not a particularly good tree for ornamental planting, although it is sometimes so used. Several insects and fungi attack the tree, among them black knot and fall web worm. The flowers are small and white. The foliage turns yellow in the fall, sometimes crimson. The fruit is a dark purple.

54. Wild Yellow Plum—*Prunus americana*.

The wild plum is a small, low-branching tree with spreading crown. Grows in most soils. Is attractive as an ornamental tree because of its foliage and graceful branching as well as for the masses of white flowers which occur in the spring. It can be used to advantage for planting on lawns and in parks.

55. Service Berry—*Amalanchier canadensis*.

(Other common names, June Berry, Shadbush.)

Note—The name is usually pronounced "Sarvice berry."

The service berry is one of the earliest of the trees to flower out in the spring and forms one of the conspicuous features of the April landscape with its racemes of white bloom and its tender reddish-brown leaves. This is a relatively small tree with slender spreading branches, which form an open crown. The tree is scattered throughout the State, preferring the rich upland soils, but reaches its best development on the mountain ridges. The service berry is a delightful tree for ornamental planting on lawns or in parks, especially since it is not subject to insect or fungus attacks.

56. The Haws—*Crataegus*.

(Other common name, Thorn.)

The haws constitute a genus with an infinite variety of species. They all have the same general characteristics. The trees are small, with broad flat crowns. The habit of branching is irregular and straggling and the limbs are covered with thorns. The members of this species are excellent for various ornamental effects. The flowers and fruit are an attractive feature. They should be used in groups or thickets or as hedges or borders. Among the most available species are:

Cockspur Thorn—*Crataegus crus-galli*.

Red (Scarlet) Haw—*Crataegus coccinea*.

Red (Scarlet) Haw—*Crataegus mollis*.

Black Haw (Black Thorn)—*Crataegus tomentosa*.

57. Black Locust—*Robinia pseudacacia*.

(Other common names, Locust, Yellow Locust.)

The black locust is one of the common trees of Kentucky, especially in limestone soils. It is a medium-sized tree, grows very rapidly and is not particular as to soil requirements. The foliage is airy in appearance, due to the fact that the leaves are composed of many small leaflets on a main stem. The branches are pendulous in a marked degree and the leaves have a drooping habit. The flowers are large, in drooping racemes and are very fragrant. The beauty of the tree is due entirely to the foliage and the flowers, since the trunk and branches are often irregular and unsightly. The black locust would be a highly desirable ornamental tree if it



BLACK LOCUST—ROBINA PSEUDACACIA.

were not subject to so many insect pests and fungus diseases, which frequently destroy it altogether. In spite of this it is largely used and maintains its popularity.

58. Honey Locust—*Gleditsia triacanthos*.

The honey locust is a large tree of pleasing form and graceful appearance. It usually branches close to the ground and forms an open irregular crown. The foliage is fern-like and delicate, both as to coloring and size. The branches are inclined to be pendulous, so that the whole tree has a feathery appearance. The leaf period is short. The tree grows rapidly and is adaptable to most soils. It is also free from insects and in this respect is preferable to the black locust. A distinctive feature is three-pronged spines with which the trunk and branches are covered. The honey locust is a good tree for certain ornamental effects where heavy shade is not desired. The flowers of the honey locust are neither so conspicuous nor so fragrant as those of the black locust.

59. Kentucky Coffee Tree—*Gymnocladus dioica*.

Although this tree is found widely distributed in Kentucky, especially in the central and western sections, it is infrequently encountered. It is a large or medium-sized tree and prefers the rich moist soils of the bottom lands. The trunk ordinarily divides into two or more main stems and forms a narrow crown. The branches are large and conspicuous, especially in winter. The foliage appears very late in the spring. The leaves are large and doubly compound. The unique appearance of the branches and the unusual character of the leaves constitute the main features of the tree. It may be planted for ornamental purposes, but has nothing other than its peculiar features to recommend it and the further fact that it is not subject to insects or disease.

60. Yellowwood—*Cladastris lutea*.

The yellowwood is one of the rarest and most beautiful of Kentucky trees and deserves a great deal of attention for ornamental planting. It occurs naturally along the Kentucky, Salt and Dix rivers on the limestone cliffs and occurs also in Western North Carolina and Eastern Tennessee. It is a medium-sized tree with slender drooping branches, forming a spreading open crown. The leaves are compound, but the leaflets, instead of occurring in

pairs, as is usual, occur singly on opposite sides of the main rib. The flowers are large, white in color and fragrant, and are borne in long drooping clusters. It seldom flowers abundantly two seasons in succession. The yellowwood is a remarkably fine tree for ornamental purposes where a medium-sized tree is desired and where shade is not an object. It is of moderately rapid growth and does well on most soils.

61. Red Bud—*Cercis canadensis*.

(Other common name, Judas Tree.)

The red bud is a widely distributed Kentucky tree which is very noticeable in the early spring because of the deep rose-colored blossoms which appear in great profusion along the dark brown branches before the leaves are more than a suggestion. The red bud is a small tree, often a shrub, and grows in the shade of other trees. The crown is flat and spreading in trees of any size. The leaves are large and heart shaped and the dark blue-green foliage is an attractive feature in summer. The tree grows rapidly, is easily transplanted and makes an exceedingly attractive ornamental tree for parks and lawns.

62. American Holly—*Ilex opaca*.

The holly is an evergreen tree common in the Eastern Kentucky mountains, is usually a small tree, but sometimes attains considerable size. It is generally of a regular pyramidal form and is exceedingly attractive in winter because of its shining bright green foliage and red berries, which have made it a feature of our Christmas decorations. The leaves are stiff and leathery with wavy edges, toothed and tipped with spines. Although the holly thrives best in deep rich soils, it does well in other situations. In the cemetery at Frankfort the hollies are a feature of the landscape. The trees when large are not very successfully transplanted, but are easily handled when the stock is small. They should be set out in the spring as early as possible, and while it is generally recommended that the leaves be stripped off at the time of planting, this does not appear to be necessary.



AMERICAN HOLLY—ILEX OPACA.



SUGAR MAPLE—ACER SACCHARUM.

63. Wahoo—*Evonymus atropurpureus*.

(Other common name, Burning Bush.)

Usually a shrub, occasionally a small slender tree common in Central Kentucky along fences and stone walls. The wahoo is attractive for ornamental planting because of the coral red fruit, which is a conspicuous part of the autumn landscape.

The Maples.**64. Sugar Maple—*Acer saccharum*.**

(Other common names, Sugar Tree, Hard Maple.)

The sugar maple is widely distributed throughout Kentucky and everywhere abundant. It is undoubtedly one of the most satisfactory (if not the most satisfactory) tree for street planting and is equally desirable for general ornamental purposes. It is a medium-sized tree of fairly rapid growth and forms a round compact crown of symmetrical shape. In the open it begins branching close to the ground so that it is usually necessary to trim it up away from the sidewalk or lawn. The leaves are large deep blue-green with an attractive outline. The tree gives a dense shade. The foliage is brilliant in autumn, displaying varying combinations of yellow, orange and crimson. The sugar maple is adaptive to a variety of soils and is not so subject to insect or fungi attacks as other species of this genus.

The black maple (*Acer nigrum*) is a closely allied species of the sugar maple and has the same characteristics. The Norway maple (*Acer platanoides*) is also a closely related species from Europe which is extensively planted, but does not seem to have any points to recommend it over the native species except a slightly longer leaf period and a greater freedom from insect troubles and disease.

65. Silver Maple—*Acer saccharinum*.

(Other common names, Soft Maple, Swamp Maple, Water Maple.)

The silver maple, or water maple (as it is more widely known in Kentucky), is a common tree throughout the State in moist situations, especially along the banks of streams. It is a large tree with widely spreading branches and irregular crown. Often the smaller branches are notably long and pendulous. The foliage is attractive, not only because of the outline of the leaves, but because of their

color, which is dark green above and silvery white below. In a strong wind the leaves all seem to turn the silver side out and give the tree a striking appearance. In autumn the leaves turn yellow and bright scarlet. The water maple is one of the commonest shade trees of Kentucky, especially along streets, because of its rapid growth and the ease with which it is transplanted. It is not, however, a desirable shade tree, for several reasons. The limbs are very brittle and easily broken by the wind. After every hard rainstorm small branches of this species are a common sight on the ground and often large limbs are broken off or the tree seriously split. Also the silver maple is very subject to fungus disease and is short-lived. Fungus disease develops rapidly after careless pruning, topping or other injuries.

66. Red Maple—*Acer rubrum*.

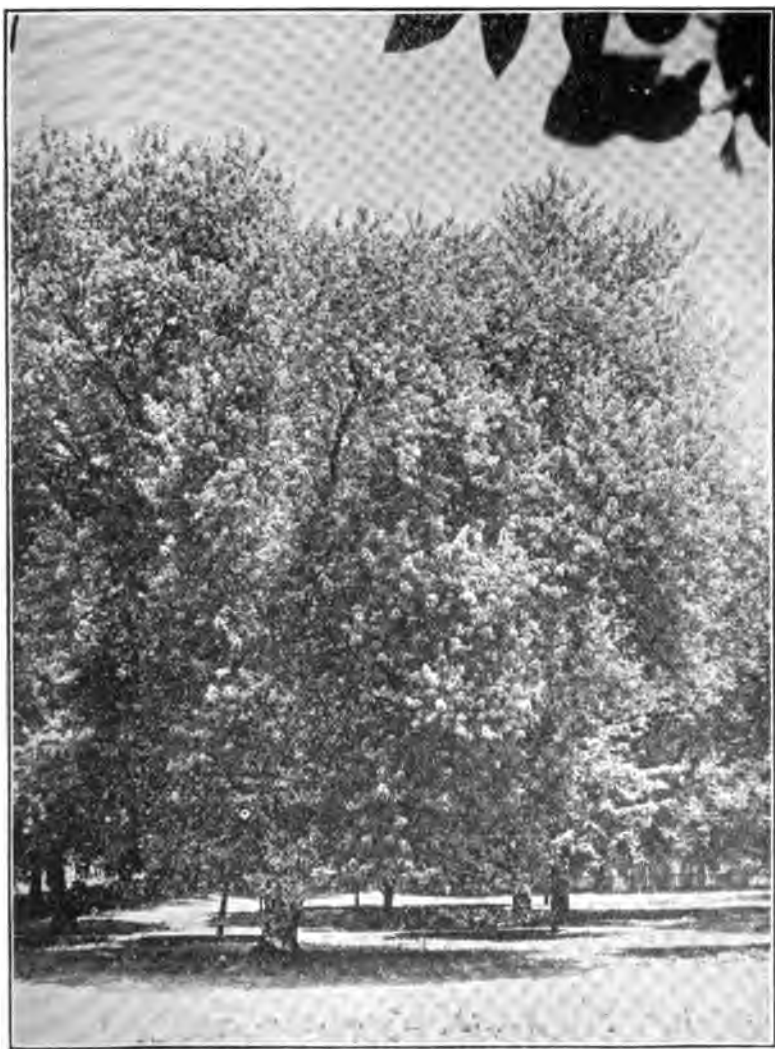
(Other common names, Soft Maple, Water Maple.)

The red maple is also common throughout the State and is found naturally in the same situations as the silver maple, but adapts itself readily to much drier situations and a variety of soils. It is a small or medium-sized tree with upright branching habit less regular than that of the sugar maple and more so than that of the silver maple. The foliage is dark green above and a paler green beneath. The glory of the red maple is its autumn foliage, which is brilliant crimson and scarlet. The red maple is an excellent tree for street planting, also for lawns and parks.

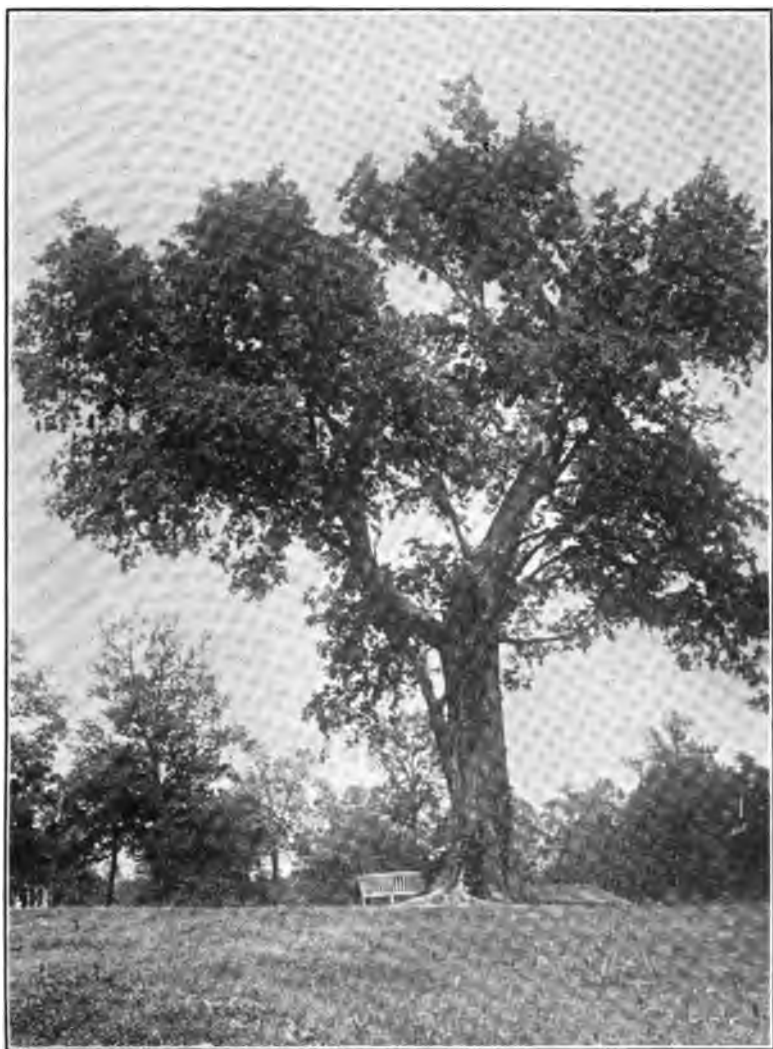
67. Box Elder—*Acer negundo*.

(Other common name, Ash-leaved Maple.)

The box elder is found widely distributed along streams and is extensively planted in much drier situations. It is a medium-sized tree and under certain conditions is sometimes very shrub-like in form. The box elder grows rapidly and forms a round compact crown. The ash-like leaves are an interesting feature and the green branchlets are unique. The tree is short-lived, but is easily transplanted and available along streets or elsewhere when quick shade is desired. The leaves in autumn turn a dull yellow.



SILVER MAPLE—ACER SACHARINUM.



WHITE ELM—ULMUS AMERICANA.
(An ancient specimen with several tons of cement inside its trunk)

The Buckeyes.**68. Ohio Buckeye—*Aesculus glabra*.**

(Other common name, Buckeye.)

The Ohio buckeye is a common tree throughout Kentucky. It is a medium-sized tree with a regular round or oval crown. The leaves are compound and palm shaped, a light green in color above, slightly paler on the lower surface. The flowers, borne in upright clusters at the ends of the branches, are a greenish yellow in color and rather inconspicuous. The buckeye is available for ornamental planting along streets or on lawns and in parks.

69. Yellow Buckeye—*Aesculus octandra*.

The yellow buckeye very closely resembles the Ohio buckeye, except that it is a taller tree. It is a more desirable species for planting, especially the variety which has red or purple flowers. The branches are often pendulous.

70. Horse Chestnut—*Aesculus hippocastanum*.

The horse chestnut was introduced into Europe from China and from Europe was introduced into the United States, where it has become a favorite for street planting or in other situations. It is a medium-sized tree of very formal outline and appearance. The crown is round or broadly oval in form. The leaves are large, palmately compound, and dark green in color. The flowers are very conspicuous and are borne on upright spikes at the ends of the branches. They are creamy white in color, with red and orange splashes, so that when the tree is in flower it looks as if it was lit with candles. The horse chestnut is fairly free from fungus troubles or insect pests, but is liable to sun scald. It is a good tree for street planting, especially along wide avenues. The shade is dense. The leaves fall early and have nothing to recommend them in the way of autumn coloring.

71. Yellow Buckthorn—*Rhamnus caroliniana*.

(Other common name, Indian Cherry.)

The yellow buckthorn is usually a shrub, sometimes a small tree with spreading top and slender branches. It is available for ornamental planting because of its smooth dark green leaves and conspicuous fruit, which is black in color.

72. American Linden—*Tilia americana*.

(Other common names, Linn, Basswood.)

The linden is a widely distributed Kentucky tree of medium or large size and with a broad round crown. The branches spread considerably and are often pendulous. The leaves are large, unequally heart shaped and deep dull green in color, so that the shade is very dense. The linden is adaptable to a variety of soils. Although subject to some extent to insect pests, it is an excellent tree for street planting and is a general favorite. The foliage turns a pale yellow in the fall. The white basswood (*Tilia heterophylla*) is hardly to be distinguished from the foregoing species, while the European species (*Tilia europaea*) is very similar. The European linden is extensively planted and by some is considered superior to the American species for ornamental purposes.

73. Hercules' Club—*Aralia spinosa*.

(Other common name, Angelica Tree.)

The Hercules' club is a small tree with a stem covered with sharp prickles. The leaves appear at the ends of the branches in tufts and are long and doubly compound, giving the tree a palm-like appearance. The enormous clusters of small white flowers which appear in midsummer are a conspicuous feature. It has a particularly bare, forbidding aspect in winter. The large leaves are the chief ornamental feature.

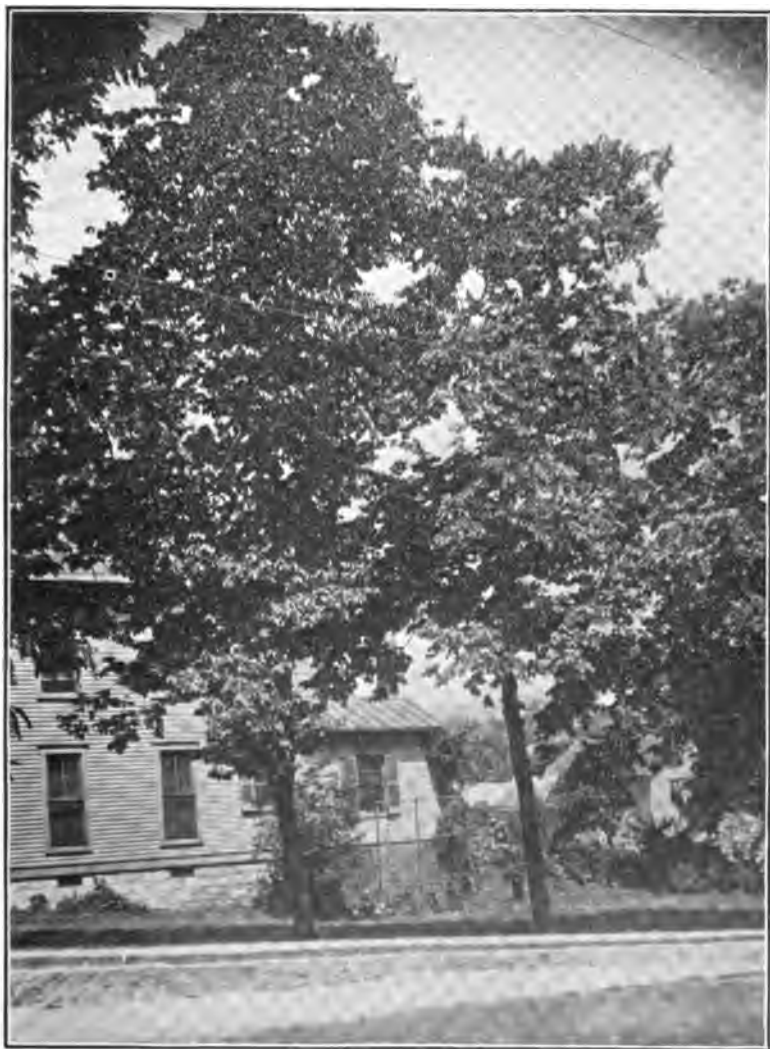
74. Black Gum—*Nyssa sylvatica*.

(Other common names, Tupelo, Pepperidge.)

The black gum occurs throughout the State. It is a large tree with a straight prominent trunk and slender branches, forming a rather narrow, cylindrical crown. The branches, especially the lower ones, often have a pronounced droop, which adds to the attractiveness of the tree. The leaves are rather thin and shiny green in color. The black gum is not especially particular as to soil requirements, but likes plenty of moisture. It grows fairly rapidly. The fruit is a dark blue berry, occurring in clusters of two or three. The autumn foliage is particularly beautiful, the leaves turning bright scarlet, often a purplish red, and sometimes orange yellow. The black gum is an excellent tree for ornamental planting in parks or on lawns.



AMERICAN LINDEN—*TILIA AMERICANA*.



PERSIMMON TREES—DIOSPYNUS VIRGINIANA.

75. Dogwood—*Cornus florida*.

The dogwood, with the service berry and the red bud, is the glory of the Kentucky woods in spring. It is a small tree with a slender trunk and fine branches. The foliage is so arranged that it appears to lie in layers and the crown is broadly flat. The white flowers appear in early spring and are large and conspicuous. The dogwood is rather hard to transplant, but its exceedingly ornamental appearance make it worth whatever extra effort is used in its behalf. The autumn foliage is also an attractive feature since the leaves turn a bright scarlet. The berries turn a bright red when ripe and their clusters add to the attractiveness of the tree during the fall months.

76. Sourwood—*Oxydendron arboreum*.

(Other common name, Sorrel Tree.)

The sourwood is a small tree with slender spreading branches, which form an irregular round or flat crown. The leaves are a bright yellowish green in color with a smooth shiny surface, and are decidedly sour to the taste. The flowers are white and bell shaped and occur in long racemes resembling lilies of the valley. The leaves in fall turn a bright red. The sourwood can be used to advantage for ornamental planting.

77. Persimmon—*Diospyros virginiana*.

The persimmon in Kentucky is often a tree of considerable size, though it appears in thickets as a dwarfed individual, sometimes a shrub. It is slender in form, with long drooping branches, forming a more or less cylindrical crown. The leaves are thick, dark green in color. The ripe fruit, which is delicious after a frost has removed its astringency, is a round fleshy drupe, orange yellow in color, with a purplish red cheek. The foliage sometimes falls without changing color, although the leaves often turn yellow or crimson. It is a graceful ornamental tree, but should not be planted along streets.

78. Silver Bell—*Mohrodendron carolinum*.

The silver bell is a tree of medium size, which is highly desirable for lawns or parks because of the mass of white flowers which cover the tree in early spring. It should be extensively planted.

The Ashes.

79. White Ash—*Fraxinus americana*.

The white ash is typical of the ash trees and is found widely distributed throughout Kentucky. It is a large or medium-sized tree, which grows best in a moist rich soil. It is noticeably erect in its habit of branching and forms a conical or round crown. The leaves are compound, occur in tufts at the ends of the twigs and are a yellow-green in color. The leaf period is short. The white ash grows rapidly, is easily transplanted and is desirable for street planting or landscape effects, since it is not especially subject to insect or fungus attacks. The foliage in autumn turns yellow, sometimes displaying shades of purple or violet.

80. Red Ash—*Fraxinus pennsylvanica*.

The red ash resembles the white ash very closely except that it is usually a smaller tree. It may be used in a like manner.

81. Green Ash—*Fraxinus lanceolata*.

The green ash is also a smaller tree than the white ash and is less common throughout the State. It is adapted for street planting or general ornamental effects.

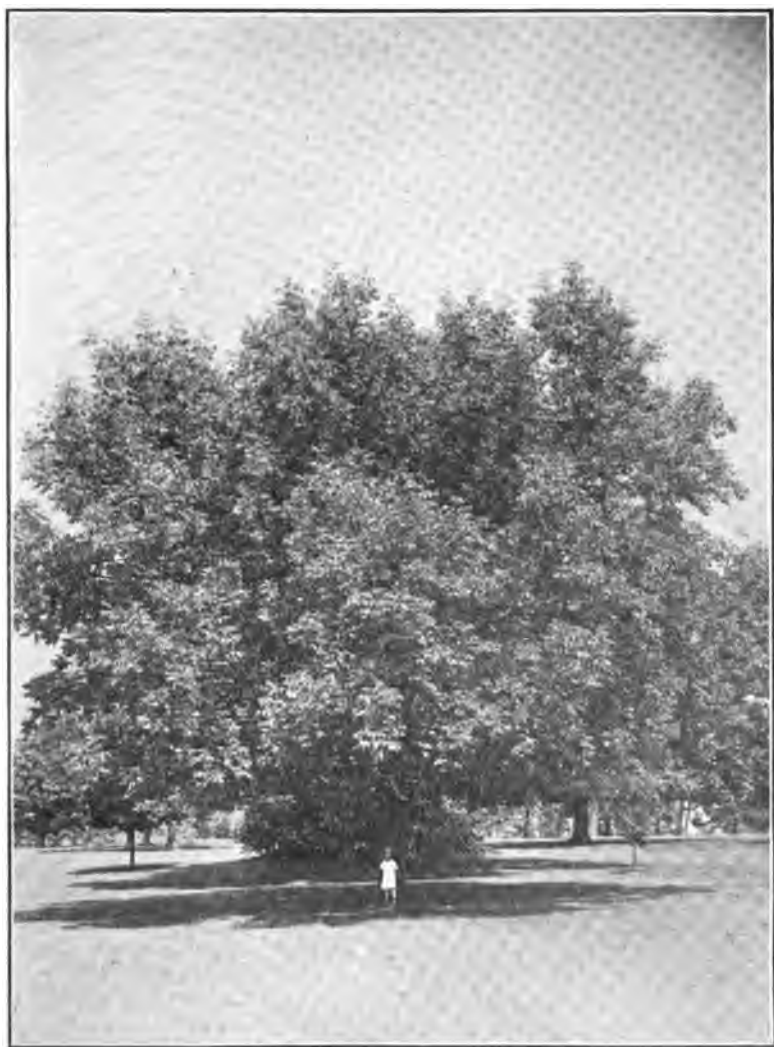
82. Fringe Tree—*Chionanthus virginica*.

The fringe tree is a small slender individual with an open spreading crown. The leaves and flowers appear at the same time in early summer and the combination of long snow-white clusters of flowers with the light green of the foliage is especially beautiful. The tree has a markedly ethereal appearance. It is an excellent tree for ornamental purposes.

The Catalpas.

83. Catalpa—*Catalpa catalpa*.

The catalpa is a tree which develops a decidedly ungraceful form. The trunk is short, the branches large and straggling, forming a wide-spreading, irregular crown. Yet the catalpa is a great favorite for lawns and parks because of the blossoms, which are large, fragrant and showy and are borne in clusters of considerable size at the ends of the branches. The flowers are pure white



WHITE ASH—FRAXINUS AMERICANA.



CATALPA—CATALPA CATALPA.

splashed with purple and orange and resemble orchids somewhat. The leaves are large, heart shaped and bright yellow-green in color. They turn brown in autumn and fall off. The tree is adaptable to many soils and grows very rapidly.

84. Western Catalpa—*Catalpa speciosa*.

This catalpa is very similar to the foregoing species, but has a more upright form and is more available for street planting on this account. If this species is cut off close to the ground when two years old and allowed to sprout and then one particularly thrifty sprout left to grow, it will develop a straight upright stem in a remarkably short space of time, and this practice will usually result in more satisfactory trees for street purposes than if the tree were allowed to develop naturally. The catalpa seems to be a much overrated tree.

85. Paulownia—*Paulownia imperialis*.

(Other common name, Emperor Tree.)

The paulownia is not a native tree, but is so extensively planted for ornamental purposes that it is included here. It resembles in a great many respects the catalpa (*catalpa catalpa*). The tree is small and forms an open widely spreading crown. The leaves are very similar to the catalpa and the fragrant flowers, while similar in form, are a purple or lilac color. It is a very rapid grower and is a tree of striking appearance.

86. *Ailanthus*—*Ailanthus glandulosa*.

(Other common name, Tree of Heaven.)

The ailanthus is also another tree which has been introduced into this country, but has become so widely distributed that it is spontaneous over a large part of the Eastern United States. It is a tree of very rapid growth with large prominent branches. The leaves are borne in tufts at the ends of the branches and are long, slender and frond-like, with a decidedly graceful droop, so that the tree has an almost tropical appearance. The ailanthus grows in the most unfavorable situations and will stand great abuse, so that it is peculiarly adapted to city life, where it often thrives under conditions that other species would not tolerate. It is free from insect or other troubles. The flowers of the male trees have a particularly disagreeable odor.

TREES SUITABLE FOR STREET PLANTING.

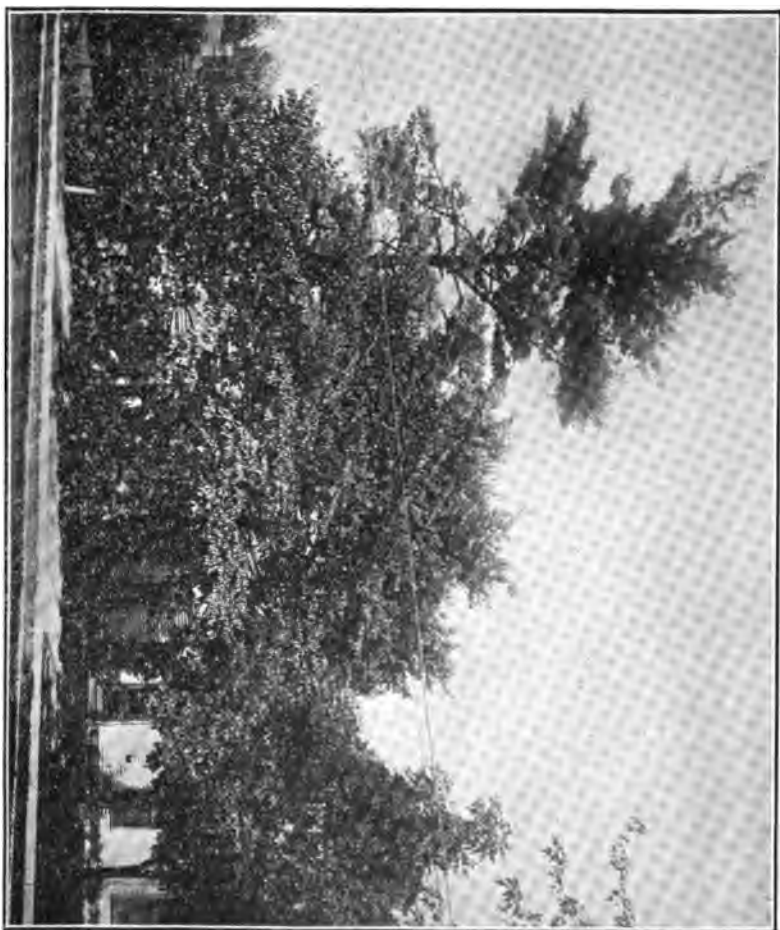
An effort is here made to classify the trees according to their rapidity of growth as "rapid," "fairly rapid" and "slow." Trees which are starred are particularly desirable trees for street planting because of many qualities.

Cottonwood	(<i>Populus deltoides</i>).....	Rapid
*Red Oak.....	(<i>Quercus rubra</i>).....	Fairly rapid
Black Oak.....	(<i>Quercus velutina</i>).....	Slow
*Scarlet Oak.....	(<i>Quercus coccinea</i>).....	Slow
*Pin Oak.....	(<i>Quercus palustris</i>).....	Fairly rapid
*White Elm.....	(<i>Ulmus americana</i>).....	Fairly rapid
Slippery Elm.....	(<i>Ulmus pubescens</i>).....	Fairly rapid
Rock Elm.....	(<i>Ulmus racemosa</i>).....	Fairly rapid
Hackberry	(<i>Celtis occidentalis</i>).....	Fairly rapid
*Tulip Tree.....	(<i>Liriodendron tulipifera</i>)....	Rapid
*Sweet Gum.....	(<i>Liquidambar styraciflua</i>)....	Fairly rapid
*Sugar Maple.....	(<i>Acer saccharum</i>).....	Fairly rapid
*Norway Maple.....	(<i>Acer platanoides</i>).....	Fairly rapid
Silver Maple.....	(<i>Acer saccharinum</i>).....	Rapid
*Red Maple.....	(<i>Acer rubrum</i>).....	Fairly rapid
Ohio Buckeye.....	(<i>Aesculus glabra</i>).....	Fairly rapid
Yellow Buckeye.....	(<i>Aesculus octandra</i>).....	Fairly rapid
*Horse Chestnut.....	(<i>Aesculus hippocastanum</i>)...	Fairly rapid
*American Linden.....	(<i>Tilia americana</i>).....	Fairly rapid
*European Linden.....	(<i>Tilia europaea</i>).....	Fairly rapid
Black Gum.....	(<i>Nyssa sylvatica</i>).....	Fairly rapid
White Ash.....	(<i>Fraxinus americana</i>).....	Fairly rapid
Green Ash.....	(<i>Fraxinus lanceolata</i>).....	Fairly rapid

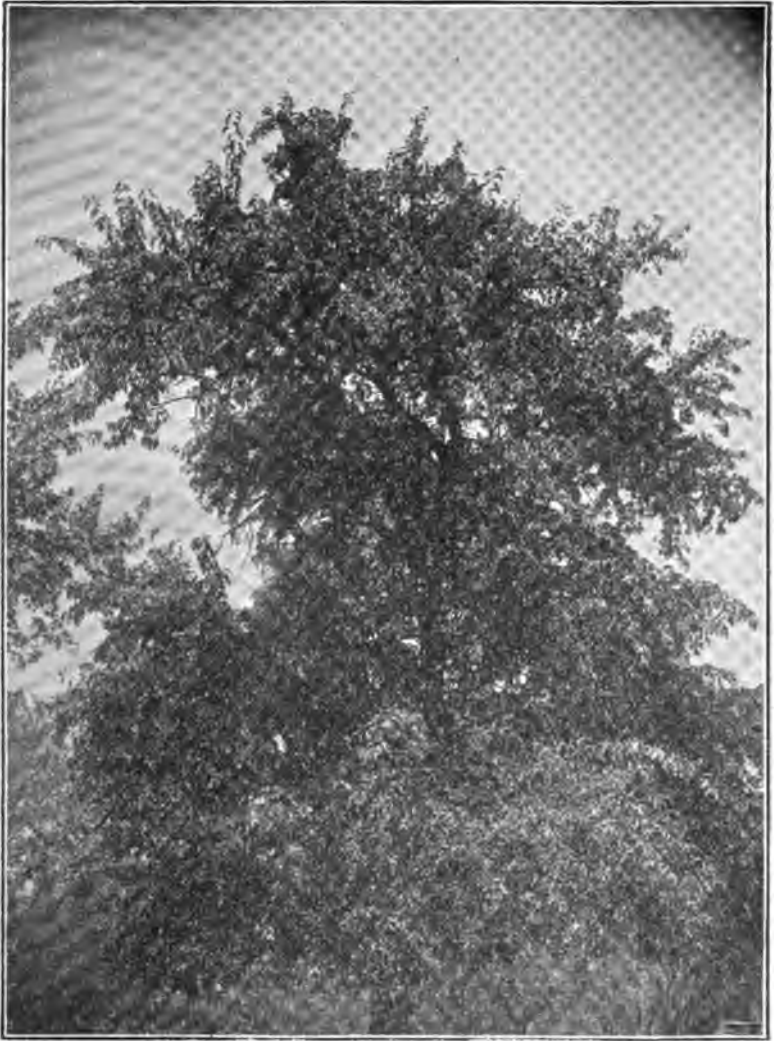
Flowering Trees Particularly Suitable for Lawns and Parks.

The time of flowering is designated as "Early Spring," "Spring," "Early Summer" and "Summer."

Chestnut	(<i>Castanea dentata</i>).....	Summer
Tulip Tree.....	(<i>Liriodendron tulipifera</i>)..	Spring
Cucumber Tree.....	(<i>Magnolia acuminata</i>)....	Spring
Umbrella Tree.....	(<i>Magnolia tripetala</i>).....	Early summer
Ear-leaved Magnolia....	(<i>Magnolia Fraseri</i>).....	Early summer
Large-leaved Magnolia..	(<i>Magnolia macrophylla</i>)...	Early summer



RED MULBERRY—*Morus rubra* in the center (foreground)
WHITE PINE—*Pinus strobus* to the left (background)



OSAGE ORANGE—TOXYLON POMIFERUM.
(An unusually large specimen)

Evergreen Magnolia.....	(<i>Magnolia foetida</i>).....	Early summer
Service Berry.....	(<i>Amalanchier canadensis</i>)..	Early spring
Black Locust.....	(<i>Robinia pseudacacia</i>).....	Spring
Yellowwood	(<i>Cladastris lutea</i>).....	Spring
Red Bud.....	(<i>Cercis canadensis</i>).....	Early spring
Horse Chestnut.....	(<i>Aesculus hippocastanum</i>)..	Spring
Hercules' Club.....	(<i>Aralia spinosa</i>)	Summer
Dogwood	(<i>Cornus florida</i>).....	Early spring
Sourwood	(<i>Oxydendron arboreum</i>)..	Early spring
Silver Bell.....	(<i>Mohrodendron carolinun</i>)..	Spring
Fringe Tree.....	(<i>Chionanthus virginica</i>)....	Spring
Catalpa	(<i>Catalpa catalpa</i>).....	Early summer
Western Catalpa.....	(<i>Catalpa speciosa</i>).....	Early summer
Paulownia	(<i>Paulownia imperialis</i>).....	Spring

Trees That Have a Particularly Brilliant Autumn Foliage.

Red Oak.....	(<i>Quercus rubra</i>)
Scarlet Oak.....	(<i>Quercus coccinea</i>)
Pin Oak.....	(<i>Quercus palustris</i>)
Sweet Gum.....	(<i>Liquidambar styraciflua</i>)
Red Maple.....	(<i>Acer rubrum</i>)
Sugar Maple.....	(<i>Acer saccharum</i>)
Black Gum.....	(<i>Nyssa sylvatica</i>)
Dogwood.....	(<i>Cornus florida</i>)
Sourwood.....	(<i>Oxydendron arboreum</i>)

THE FARM AND THE WOODLOT.

Undoubtedly, one of the most important phases of the forestry work, so far as the individual States are concerned, is the question of the woodlot and its improvement. In the Eastern States—that is, those east of the Mississippi river—a very considerable portion of the forested areas within each State is in the form of woodlots which are a part of and an adjunct to the farm so that in any comprehensive forest policy for the Eastern United States a great deal of attention must be focused upon this phase of the work. This is, undoubtedly true so far as Kentucky is concerned, where, as a whole, the land is held in fee simple by the citizens of the State as farms from a few acres in size up to several thousand acres. By the majority of the owners of these farms, the value and importance of the woodlot is little understood nor has the practice of forestry as it applies to these woodlots any significance whatsoever. The object of this bulletin is to make clear just what forestry is, the relation of scientific forestry to the improvement of the woodlot and the economical part which the farm woodlot plays in the industrial and social welfare of the State. As a matter of fact, this is one of the most difficult features of the work to present properly, because it is a hard matter to make clear to the average individual just why a woodlot is an asset in connection with his property and how the improvement and care of his woodlot concerns him closely and means a proportional increase directly in the actual money value of the material on hand and indirectly in ways which do not present themselves readily unless the attention is focused on them—as for example, the value of a woodlot as a wind-break in connection with an orchard or in connection with the farm as a whole, or the value of a wooded area on an easily eroded hillside as a fixative for the soil and a preventative against the deterioration of the cultivated areas below it. The effort then of this bulletin will be—first, to show how the average woodlot may be brought to a standard of productivity compatible with the complete utilization of the ground, and second, to show in detail what the direct and indirect benefits of a woodlot in connection with any farm will be under the best circumstances. In the preparation of this bulletin free use has been made of all bulletins and publications on this subject which the writer has been able to get

hold of, and acknowledgment is made to these as a whole, since it would be impracticable to make complete individual acknowledgment.

WHAT IS FORESTRY?

To the average individual, forestry as a science does not mean very much. The impression is that it has to do with the trees, but to what extent and how it deals with this question is by no means thoroughly understood. In the first place, forestry deals with trees as a community and not as an individual—that is, it deals with them in the bulk and in this respect differs from kindred sciences where the individual tree is a matter of concern. The forester is often called upon to answer questions and discuss matters with relation to shade trees or ornamental trees, but this is not a matter within his province properly, but is a matter for the landscape architect or horticulturist. Forestry primarily concerns itself with the planting and growing of trees for sale at a profit. Occasionally forestry may concern itself with the growing and raising of trees for purposes where the money value of the crop, while it may not be as evident as where the trees are placed on the market and sold, is nevertheless a real money consideration. This is the case where certain areas are planted for the purification and conservation of a city water supply. Here the actual worth of the forest is the value to the people of the city or community of pure drinking water. This will be the case in the Catskill Mountains, where enormous expenditures are being made for supplying New York City with pure water and where the purity of this water supply depends upon the maintenance of certain areas in forest growth. Forestry, then, so far as it relates to the farm and woodlot, may be defined as dealing with trees as communities and the growing and marketing of these trees for a profit. It is a simple proposition, the same as raising corn. In raising corn the ground is prepared, the seed is planted at a certain time in the spring, the necessary attention is given during the growing season and in the fall it is harvested and sold. A certain price is obtained for the grain and a certain price for the stalks, usually in the form of fodder for stock. The chief value of the corn crop depends upon the number of bushels per acre of corn (grain) that have been produced and the kind and quality of corn there is to market. The kind and quality of the corn crop depends on the selection of seed. All this is accomplished

within a year's time—the planting, the harvesting, the cultivation and the sale of the product. Forestry is exactly the same proposition. The stock is selected, the trees are planted, the necessary attention is given them during the growing period, and eventually the crop is harvested and marketed for the best price obtainable. The value of the timber crop depends on how much material you raise to the acre, the kind and quality of the product you have to market and the demand in the market for the class of material to which the timber crop is particularly adapted. The chief difference is this: that, whereas, the corn crop has been planted, harvested and marketed within one growing season, a forest crop takes a period of growing seasons before it is ready to market. The precise length of this period depends on the kind of material you are to raise, as fence posts, ties, lumber, etc.

IMPROVEMENT OF THE WOODLOT.

What, then, can be done to show the man most concerned, the farmer, the importance of the improvement of his woodlot? First, an attempt will be made to set forth the matter as clearly as possible in print, which is the object of this bulletin; and the necessary steps will then be taken to furnish an ocular demonstration of the facts herein set forth by the establishment of nurseries and the maintenance of model woodlots. On the big majority of farms in Kentucky there are certain areas which are not good farm land and never will be for a variety of reasons (inferior soil, rocky soil, too steep a slope, etc.); but these lands in most cases can produce timber crops and should be producing them, since they are a commercial adjunct to the farm and bring in a revenue. As Mr. W. F. Cook, of Hickman county, says, "It is a great deal more valuable than giving the land over to weeds and wild briars."

Ordinarily, there is little or no attention paid to the woodlot on a farm, and without attention a woodlot is in much the same condition as a corn field in which no attention was paid to the kind of corn planted, and which was not cultivated during the growing season. You commonly find in a woodlot a great variety of trees, some of a valuable species and some of more or less worthless species. You also find crooked and defective and diseased trees, and further you ordinarily do not find in any particular woodlot one-half the trees that the ground will support, which is about the worst feature of all, since here is an economic waste.

PURPOSES OF THE WOODLOT.

When the improvement of the woodlot is seriously under consideration, one of the first propositions is to determine just what purpose the woodlot will serve in the economy of the farm. Ordinarily a woodlot will be maintained for the following reasons: (1) to furnish fence posts; (2) to furnish fuel; (3) as a shelter belt for certain areas or for the whole farm; (4) as a protection on steep uplands against erosion; (5) as a means of regeneration of wornout land; (6) as an investment pure and simple, without regard to immediate returns; (7) for the aesthetic value. Any combination of these reasons may prevail for the maintenance of a woodlot; however, each one of them will be discussed in its turn as separate propositions.

1. Probably one of the chief reasons for maintaining the woodlot on farms in Kentucky from the purely utilitarian standpoint will be to obtain fence posts. These are a commodity on the farm which cannot be dispensed with and for which the demand is staple. Concrete may, and will at some future date, supersede wood as fence posts, especially in rich, easily accessible agricultural regions where farming is very profitable and conducted as a business, but it will do this only slowly in remote regions, and at the present time concrete posts are not extensively used in any locality. A wood lot can then be reasonably maintained for the production of fence posts. Ordinarily the posts are largely consumed on the home farm, since they are more valuable to the producer at this point than if he should sell them; however, if there is a surplus, a market for this will not be lacking and the price obtained will more than justify the cost of the establishment of the woodlot and its maintenance up to the time of harvesting the crop. In considering the species which lend themselves most readily to the production of this class of products in Kentucky, undoubtedly black locust (*Robinia pseudacacia*) sometimes locally called yellow locust, lends itself most readily to this purpose. It is indigeneous to the State, grows fairly rapidly and lasts a long time in contact with the soil, three prime requisites of any species which is to be used in the growing of this class of material. Other species which may be used are catalpa (*Catalpa speciosa*) walnut, osage orange, chestnut and juniper (also known locally as cedar or red cedar).

2. As a general proposition, it appears that the maintenance of a woodlot for the growing of fuel, so far as Kentucky is con-

cerned, is not an important consideration. So far as my observation goes throughout the State—even in the rural districts—coal is the general fuel in use on account of the abundance of supply and is in a large number of ways cheaper and preferable to wood as a fuel. On this account the woodlot will supply only a very small amount of fuel, and consideration of this matter is not important. If it does happen that a supply of fuel wood is desirable or necessary on the farm, undoubtedly hickory and oak lend themselves most readily for this purpose. Any species of hickory grows fairly rapidly, and certain species of oak, as for instance red oak, makes a reasonably rapid growth. A woodlot for this purpose would be managed as a sprout forest.

3. The removal of forests and wooded areas of Kentucky has undoubtedly resulted in certain climatic changes. These are principally to be noticed in the prevalence of high winds which formerly did not exist, and such winds have a marked effect on certain farm activities, as for instance the handling of an orchard or the handling of stock. A shelter belt, therefore, offers protection to the farmhouse and surrounding buildings. To be of use, the shelter belt or wind break must be in the direction of the prevailing winds. Further, since in all probability a shelter belt is of most use and is most desirable in the winter time, the component species in the shelter belt should be, to a large extent, evergreens, so that the effectiveness may be as great in winter as in summer. In connection with an orchard, a shelter belt or wind break undoubtedly protects against cold and destructive currents of air which injure the orchard in various ways either by injuring the blossoms of the fruit or at a later period by injuring the fruit, which is blown from the trees by the wind and left in bad condition for shipping.

The species, then, which should compose a shelter belt should, as far as possible, have these characteristics. They should grow fast to furnish the maximum amount of protection in the shortest space of time, and should have as wide a usefulness as possible. So far as the majority of instances are concerned, the shelter belt might have two objects, the production of useful material for the farm as fence posts as well as a wind break. In this case it would be well to plant black locust in conjunction with some evergreens, as white pine or Norway spruce, hemlock or yellow pine. The number of evergreens which may be utilized for this purpose in

Kentucky are limited, but the number of hardwoods which lend themselves to this purpose is very great, as, for instance, the hickories, ashes, black locust, poplars, tulip poplar, osage orange and others. Beech also makes a good tree for the composition of a shelter belt.

4. As a protection on a steep uplands against erosion, the chief thing is to establish a forest cover. The composition of the stand is more or less immaterial, although it is always desirable that the most readily marketable species shall be used so that the woodlands, in addition to performing their protective function, may also supply an actual revenue. Therefore, as far as possible, the trees to be used should be the ashes, oak, chestnut, hickories, maples and other species, whose value in the lumber market is standard. The chief feature in regard to this protective woodland is that the forest cover shall remain unbroken.

5. As a means of regeneration of wornout land, especially hillsides, which are liable to erosion and do not lend themselves easily to a scientific rotation of crops, a forest cover is a very important factor since it furnishes to the soil the essential humus, and when such species as the black locust or honey locust are planted it furnishes the nitrogenous elements to the soil, since the locusts are legumes and produce on their roots nodules of nitrifying organisms similar to those found on the roots of alfalfa, cow-peas or soy beans.

6. As a general proposition, the raising of lumber or timber by an individual is out of the question on account of the length of time which it takes to grow the better grades of this material. Ordinarily, a tree fifty years old will furnish only the poorest grades of lumber and usually only small dimension stock. Generally speaking, one hundred years is not too small a calculation for the length of rotation when lumber is the aim. In the event that any individual plants trees for the production of the lumber, such planting is done as an investment purely and simply, since he cannot expect to see the crop harvested within his lifetime. The only monetary benefit that could possibly accrue to the owner is from the material which may have to be thinned out, or in the event that he should desire to sell his farm when the existence of a grove or woodland of healthy young trees would represent an actual money value to the purchaser. In case planting for this reason is made, the trees should be those which are the most valuable lum-

ber-producing species, as, for instance, the oaks, the ashes, hickory, sweet gum, tulip poplar, white and yellow pines, basswood and a few others.

7. It may be that in connection with the farm the presence of a grove of trees thereon will represent a value from the aesthetic and scenic standpoint where the beauty of the landscape is a matter of consideration to the owner of the land or to anyone who might desire to purchase it. In this event the kind of tree is not so important as the actual presence of trees of some kind. The general effect is the main consideration, without regard to the individual features which compose this effect.

FOREST TAXATION.

One of the most important factors in connection with the consideration of woodlots is the matter of taxation, and this is a matter which so far as Kentucky is concerned has had little attention. In the first place, there is no classification of land within the State for taxation purposes. It is a generally accepted theory among experts in this matter at the present time that there is only one fair method of taxation which may be applied to land maintained by the owner in forest growth, and that is that there should be a tax placed on the land which shall be an annual tax, and another tax placed on the forest crop when it is harvested. In no other manner does it seem probable that reforestation of suitable areas throughout the State may be accomplished, since in the first place, on account of the character of the investment the owner of the land must be assured beforehand just what his taxes on the land are to be, and in the second place the risks attendant upon the raising of a forest crop, because of the long period of years before it reaches maturity, make it essential that the crop of forest products shall be taxed at maturity when it is harvested, rather than that an annual tax shall be imposed. Certain States have already gone a long ways in this direction, and Pennsylvania has recently passed three laws dealing with the matter of forest taxation and the classification of forest land, which embrace the best features of recent thought on this subject. The essentials of the recent Pennsylvania laws are as follows:

1. Classification of suitable land set aside by the owner for forest purposes as auxiliary forest reserves.

2. Agreement with the State to maintain such land in forest growth and penalties for failure to carry out agreement.

3. Assessment of land classified as auxiliary forest reserves at \$1.00 per acre annual tax.

4. Payment by owner of 10 per cent. of the value of the forest products when harvested to the county to be distributed among the proper county funds.

5. Fixed charges on auxiliary forest reserve land of two cents per acre for schools and two cents per acre for roads.

Under these provisions it is obvious that the growing of timber on suitable areas would be reduced to a practical business basis.

Providing the tax question is sufficiently settled and definite for a period of years the regeneration of the woodlot or the establishment of one may be undertaken as a safe investment. So far as Kentucky is concerned, the present tax laws and the manner of handling the assessments in the counties are not such as to bear heavily on timbered or wooded areas. In the event that a new classification of land is made and new tax laws enacted, every effort should be made to bring about such a classification of forest land and such a system of taxation as will encourage the reforestation of suitable areas and the regeneration of the present woodlands.

REGENERATION OF THE WOODLOT.

When the question of the regeneration of the woodlot is seriously considered there are several points which stand out prominently as follows:

1. Protection.
2. Taking of stock.
3. Removal of undesirable species.
4. Selection of desirable species.
5. Method of regeneration.
6. Care and management.

1. **Protection.** It is essential that a woodlot shall be protected if it is to be an asset to the owner and brings him financial returns. There are two destructive agencies against which he must make special efforts, fire and stock. It may seem unnecessary to point out the various bad effects which fire and stock have on woodlands, but they are nevertheless here set forth in brief. **Fire** destroys timber utterly, injures it so that it is subject to insect and

fungi attacks, lowers the grade of the timber, destroys or seriously injures reproduction, destroys humus and lowers the productive capacity of the soil. There is no way in which burning over a woodland improves the character of the forest. **Stock** have a very injurious effect on trees, especially young growth. Some stock eat up the nuts and berries and seeds which are the means of reproducing the forest. Other stock browse on the young trees which have started, destroying the young growth altogether or seriously gnawing other trees, thereby leaving them badly malformed and depleted in vitality. By rubbing against small trees stock also do a great deal of harm. So stock should be rigidly excluded from the woodlot, or at least until all the trees are well developed, and even then no good is accomplished. If possible, the woodlot should be well fenced. The other destructive agencies against which protection may become necessary are insects and disease. If fire and stock are excluded, the chances of insects and disease doing serious damage is materially decreased. Diseases and insects are best kept in check by keeping the wooded area clean of dead and decaying material. In case of serious insect infestation it may in some cases pay to spray the trees, but under ordinary conditions this is not practical. The common way of fighting disease and insects is to cut down and burn all affected trees.

2. **Taking of Stock.** The next step in the regeneration of our woodland is to find out the extent and character of the stock on hand, for we cannot proceed intelligently without this knowledge. This taking of stock may be a purely ocular process or it may be a detailed estimate and description, depending on the extent of the woodland and the desires of the owner. All reproduction should be accounted for as well as the older stock on hand. The taking of stock should also involve the division of species into desirable and undesirable species, by desirable species being meant such species as it is desired to encourage because of the demand for it in the local market or because of the use which may be made of it by the owner on his farm. The desirable species will usually include the fast-growing species.

3. **Removal of Undesirable Species and Trees.** The first actual work in connection with the regeneration of the woodlot is the removal of undesirable species. When this is undertaken the local market and other markets should be carefully studied in order that, if possible, a sale may be found for the material which

is removed, so that the work may pay for itself. In determining what are undesirable species there are several factors which will govern and no specific list of trees can be cited. The desire of the owner, the market for the material, rapidity of growth and other features are among the important considerations. Such trees as blue beach, horn beam, red bud, service berry and others have no rightful place in a woodlot since they take up space without furnishing any product of value, unless the wooded area is desired for its aesthetic features. In a woodlot which is maintained for fence posts and fuel it would be poor policy to retain any but those species which make good fence post material and fuel and grow rapidly. In this matter common sense will go a long way. Also badly suppressed trees, malformed and diseased or infected individuals should be removed as far as practicable.

4. Selection of Desirable Species. In the selection of desirable species there are a large number of considerations, and the first of these is the purpose of the owner in maintaining the woodlot. For instance, if the owner desires fence posts and fencing material his woodlot will, in Kentucky, be confined to those species which produce such material **quickly**, as for example black locust, catalpa, chestnut and walnut, also it will be well to have a percentage of red cedar (juniper) in the mixture, for since red cedar grows comparatively slowly, it may be reserved to be cut as the second crop and will serve to shade the ground and prevent erosion when the faster growing species have been cut and during the restocking of the area. If fuel as well as fence post material is desired, a mixture including hickory, oak and chestnut would be desirable. If ties, posts, poles or other products are an object, certain species are desirable and are easily grown. A list of trees suitable for various purposes is herewith given. No species are included in this list which will not produce marketable material repeatedly within the lifetime of a single individual. Only in unusual cases is the raising of trees for lumber recommended as a feasible or profitable venture for the individual farm owner.

Fence posts and fencing material—Black locust, catalpa, chestnut, walnut, oak, red cedar (juniper).

Fuel—Oak, hickory, maple, chestnut.

Poles—Chestnut, catalpa, red cedar.

Ties—Black locust, catalpa, chestnut, walnut, oak.

Vehicle material and handle stock—Hickory.

5. Methods of Regeneration. There are several things which must be done to secure a good forest over the area. If natural seeding is to be depended upon for reproduction, the ground must be prepared to receive the seed. Sometimes the sod will be so thick over the area that seeds get no chance to generate. In this case the sod should be plowed up, if possible, or harrowed so that the seeds may have a suitable opportunity to start. To do well it is necessary that the seeds and seedlings have easy access to the mineral soil. It may be that the ground is so shaded that seedlings do not receive the necessary sunlight. If this be so sufficiently large openings should be made in the forest cover to admit the required light. It may be that natural seeding does not proceed rapidly enough and that this must be supplemented by the sowing of seed artificially. When artificial sowing is resorted to it will be found that there are several methods of sowing which recommend themselves: broadcast, sowing in prepared rows, sowing in prepared seed spots and sowing with a corn planter either in rows or spots. This last method is recommended as being usually most satisfactory and economical. Sowing with a corn planter can be resorted to only in the case of small seeds. Large seeds, such as walnuts, hickory nuts, etc., must be planted by hand, but when this is done they are liable to be eaten by squirrels or other rodents, in which case it may be necessary to plant such seeds in small protected seed beds and then transplant the seedlings to the place where they are desired.

If planting is to be depended upon for reforesting, the nursery stock obtained should be small seedlings not over one or two years old or transplants two to three years old. If the amount of planting to be done is large, it may be wise to start seed beds close to the ground where the planting is to be done and not to depend on commercial nurseries for stock.

6. Care and Management. It will be found that the care and management of the woodlot is relatively a simple matter after the forest is well established and that the character of the stock and the amount and quality of the products will improve materially with management. There are certain systems of management which recommend themselves for woodlots, such as the (1) simple coppice; (2) polewood coppice; (3) coppice with standards or variations of these. The three methods here cited are briefly described.

Simple Coppice. This is a system of management wherein all

the stand is cut and the restocking of the area is secured by sprouts from the old stumps. Under this system the stand should be cut at an age not to exceed twenty-five years and preferably about fifteen years, although this is usually impossible from a commercial standpoint. The cutting should be done in the late fall, winter or early spring. The stumps should be cut low, smooth and slanting so as to shed water and prevent decay. After a time under this system the sprouting capacity of the stump is greatly reduced and arrangement must be made to secure new individuals either by direct seeding or by planting.

Pole Wood Coppice. This system involves the leaving of certain trees until they reach the pole wood stage and are suitable for such products as ties, poles, etc. It is a favorite method of handling woodlots.

Pole Wood Standards. This system involves the leaving of a certain few trees until they are of large size. Such trees should usually be from the seed.

In the management of the woodland it will be necessary to make several cuttings before the final cutting at the end of the rotation, usually one or two. A thinning may early become necessary to give the best specimens a better chance for growth. Sometimes two thinnings may be required. Often a thinning may be required to secure reproduction by opening up the forest cover and exposing the ground so that young growth may have the opportunity to get started.

In the final cutting, when all or the major part of the crop is cut, the material should be removed from the ground as rapidly as possible and the brush disposed of when practical. The disposal of brush will usually take the form of lopping the limbs from the tops and scattering them, so as to secure early decay of the waste material. Sometimes the brush may be advantageously piled and burned.

CONCLUSION.

No attempt has been made in this bulletin to deal exhaustively with the woodlot problem. The desire has been to point the way for the improvement of the woodlots in Kentucky. Individual

cases deserve specific consideration, and only the main features of the proposition have been touched upon. The State Forester will cheerfully answer by mail all questions relating to this subject so far as it is possible to do so, and will give such personal advice and direction as the time at his disposal and the circumstances warrant. The illustrations are from photographs loaned by the Forest Service, United States Department of Agriculture.

Second Biennial Report

The State Forester
Of Kentucky



1915

Forestry

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J. E. BARTON, State Forester. Digitized by Google

Kentucky. State Board of Forestry.

SECOND BIENNIAL REPORT
THE STATE FORESTER
OF KENTUCKY
1915

Published by the Direction of the State Board of
Forestry.

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Chairman.

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Commissioner of Agriculture.

JOSEPH H. KASTLE,
Director Kentucky Experiment Station.

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MRS. MASON MAURY,
Louisville.

J. E. BARTON, State Forester.



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REPORT OF THE STATE FORESTER

INTRODUCTION.

When the First Biennial Report of the State Forester was compiled in 1913, the State Board of Forestry had been in existence a little over a year and the appointment of the State Forester had been in effect almost exactly a year, so that the results of the work as set forth in the first report were more of an effort to forecast the direction which the work of the department would take in Kentucky than an actual record of work which had been accomplished up to that time. At the present time, since the appointment of the State Forester has lasted approximately three years, it is possible to relate with a great deal more certainty the benefits actually accomplished by the work of the State Board of Forestry up to the present and to forecast with a great deal more surety the logical development of the work for several years to come. The State Board of Forestry has remained the same as originally constituted. Each of the appointed members has been reappointed as the time of his term expired. Mr. W. H. Mackoy, of Covington, was reappointed on June 12, 1913; Mrs. Mason Maury, of Louisville, was reappointed on June 12, 1914; Hon. Johnson N. Camden, of Versailles, was reappointed on June 12, 1915. Each of the appointed members of the board was reappointed for a term of four years.

EDUCATION.

It was set forth clearly in the First Biennial Report of the State Forester that it was only by means of education that the value of a definite forest policy in the State would become clear to the public in general, so that the benefits to be derived therefrom might become

part of the public consciousness. That this is true has been increasingly evident to the State Forester during his work in the State in the past three years, and it has also become much more evident that one of the most important points where this education should be carried on was in the public schools and thence, through the children and by their agency, into the homes.

ADDRESSES.

Opportunities for addresses about the forestry work in Kentucky have presented themselves on every hand and the State Forester has made use of these opportunities whenever presented to indicate what has been done by the State in this direction and what can be accomplished by united effort on the part of interested individuals. These addresses have been made in large numbers before the circuit courts at the opening of their sessions. In this manner the law on the subject, especially relating to the matter of forest fires, was brought to the attention of a goodly portion of the county wherein such addresses were made. Also, addresses have been given before the Women's Clubs of the State, the Boy Scout organizations, and in the assemblies of the public schools. In addition, a large number of addresses have been delivered before interested timberland owners throughout the eastern counties of the State in the interest of the formation of Forest Fire Protective Associations, the nature of which will be discussed later in this report. The State Forester addressed by invitation the meeting of the Western North Carolina Forest Conservation Association at Asheville, in June of 1914.

BULLETINS.

The number of bulletins published by the office of the State Forester the last two years has not been very large. In fact, the material contained in the present biennial report will constitute the largest bulletin published in this period. In addition to this, there has been published by this office a Manual of Instructions for County Forest Wardens and others, which contains in

addition to instructions a compilation of all information in regard to forest protective work accomplished in the State up to the time the publication was made. Several pamphlets have been published for distribution, notably one of the "Progress of Forestry in Kentucky" which was distributed at the State Fair in the fall of 1915.

PUBLICITY.

This department has continued its policy of presenting the features of its work at every opportunity in the magazines and newspapers throughout the State, believing that, since the department was created for the benefit of the people of the State looking to the best use and conservation of one of the State's most valuable resources, the information with regard to the activities of the department should be made as much a matter of public concern as possible. The most recent effort in this direction was the publication through the agency of the Western Newspaper Union and the American Press Association of a quantity of plate matter which was sent out to over one hundred and twenty newspapers of the State and has been very largely used by them in their weekly publications. This publicity matter consists of illustrations of the work which is being done by the department and of text relating to the activities in which the State Board of Forestry is engaged. Further, through the co-operation of the United States Department of Agriculture under the Weeks Law, additional publicity has been possible, especially in the direction of protection from forest fires. The Federal government agreed to spend a sum equal to that spent by the State in furthering the cause of fire protection in the State provided the amount spent by the Federal government should not exceed \$100.00. Under this arrangement the State Board of Forestry has been successful in having printed sanitary drinking cups to the number of fifteen thousand and has distributed these among the schools of the State thereby calling to the attention of the school children many valuable features of forest protection as well as calling attention to and emphasizing the State law with regard to sanitary drinking cups. Also, under

this same arrangement there has been published a large number of notices for distribution, calling the attention of the general public to the danger from forest fires and the damage which results therefrom. As wide a distribution of these notices has been sought as possible. The railroads have shown an earnest desire to co-operate in this matter, since they realize the importance of the protection of the forests from the destructive agency of fire in the regions through which they extend, and they uniformly agreed to post notices at each of their stations within the State. These notices are also being distributed through the agency of the county forest wardens.

Each year since and including 1913 the office of the State Forester has had an exhibit at the State Fair in Louisville in connection with the Forestry and Mineral display at the State Fair. This has increased a little each year in size and in scope. The exhibit has consisted in the main of material furnished by the Forest Service of the United States Department of Agriculture, for the loan of which the State of Kentucky is greatly indebted to the Service. The material embraced a display of various uses for wood material, distribution of wood products in the State and transparencies and bromides representing various phases of forest life and conditions. The woods of the State have been represented by a display of lumber furnished by the members of the Hardwood Club of Louisville. The value of this exhibit, so far as the general public is concerned, is adequately shown by the interest displayed therein. The place in which the exhibit has been shown is not adequate to the purpose of such a display and it is the earnest desire of the State Forester that through the wood-using industries of Kentucky a building devoted exclusively to the forest and wood-using industries of the State might become available and that an adequate collection may be brought together as the opportunity offers and become a feature of the annual State Fair.

FOREST PROTECTION.

The protection of the forests from fire has been one of the chief aims of the work of the office of the State Forester during the existence of the State Board of Forestry, and it has also been the consistent endeavor to arouse the public attention to the fact that each year an enormous damage results from this source, and that, further, it is a destruction and loss which is largely due to carelessness and can be avoided in a large measure. In the fall of 1913, Kentucky was successful in getting co-operation with the Federal Government under the Weeks Law whereby the sum of \$4,000 was placed at the disposal of the State for work in connection with the protection of the forests in the mountain regions, contingent upon the expenditure of a like sum upon the part of the State. This co-operation has been continuously in force with increasing benefits to the State. The amount of money available to the State from this source remains the same. The character of the agreement, however, with the Federal government has been slightly modified and the modification has been distinctly to the benefit of the State in making possible the employment of better men for county wardens. It was stipulated in the original agreement that not more than \$2.00 per day should be paid to county forest wardens appointed and paid out of the Federal funds. It is now possible to pay such wardens at the rate of \$2.50 per day, or \$75.00 per month. Under this arrangement it is possible to secure much better men than were heretofore obtainable.

The lines along which forest protection has developed in Kentucky during the last two years are much the same as forecast in the First Biennial Report. County wardens have been employed in those counties in the State where there was a large amount of timber and where the proper demand for the protection of the timber justified the appointment of a county forest warden. The number of wardens employed during the last two years has averaged from twenty-five to thirty during the two annual seasons when forest fires may be expected. These seasons have lasted approximately two months in the spring and two months in the fall, although

the danger season may be considered as consisting of the following months: March, April and May in the spring, and September 15 to December 15 in the fall. The most notable development in the matter of fire protection in Kentucky has been the establishment of a considerable number of Forest Fire Protective Associations in the State, and this was a logical step after the attention of the timberland owners had been called to forest protection. It was very plain that a great amount of good could not be accomplished by any one individual warden in a single county and that in order that the most good might result it was necessary that the timberland owners and all others interested in forest protection co-operate and organize to secure this protection by every means available, and that they stand back of the county wardens and any others who are interested in the work that was being done. Accordingly forest protective associations have been organized, the earliest of which was the one in Harlan County. Subsequent organizations have been formed in Lewis, Letcher, Clay, Leslie, Jackson, Knott, Pike and Floyd. The success of the organization in Harlan County has been so marked that it has been a very strong argument for like associations in other counties of the State. At the present time practically all the timberland in Harlan County, about 200,000 acres, is embraced in this association. The organization of these associations is purely local and consists of the timberland owners, lessees, operators and all others interested in the protection of the forests from fire. Officers are elected from the local members of the association and the chief feature of such an association is that an assessment is levied on the members, based on the acreage owned by each, to provide for the necessary funds of carrying on the work. The amount of this assessment is left to the individual association. In the Harlan County Association a maximum assessment of 1c per acre has been arranged for. In other associations a maximum assessment of $\frac{1}{2}$ c per acre has been the amount which has been almost universally provided. The funds of these associations are disbursed at the instance of the local officials for the benefit of forest protection in the county. The connection between such associations and

the State Forester has been in the nature of an agreement whereby the cost of forest protection in the county has been divided equally between the State and the local association. In this manner the expenses of the State have been very materially reduced, and on the other hand the amount of funds available as a whole has been very decidedly increased so far as the individual county is concerned. One of the distinct benefits of such an association within the county has been to create a sentiment against the setting of forest fires and to bring to the attention of the proper legal authorities the destruction and damage which result from such fires as do occur. At the present time practically the whole southeastern end of the State is embraced in such associations and it is felt that by co-operation between the associations a system of lookout towers and notification of fires by telephone may be easily developed.

FOREST EXTENSION.

As was indicated in the First Biennial Report of the State Forester, the establishment of two forest nurseries within the State, one at Louisville and one at Frankfort, was authorized by the State Board of Forestry with the idea that commercial planting within the State might thus be best encouraged. Work in connection with these nurseries has proceeded up to the present time. The Louisville nursery was established in the fall of 1914. That there was an actual demand for the character of service which these nurseries were able to furnish was indicated by the fact that in the spring of 1915 all the available stock in the nursery at Louisville was disposed of to the public at what was then figured to be the cost of the material. Applications for stock at that time showed that, if the material had been available, from ten to twenty thousand seedlings could have been disposed of without any effort. Applications for material available in the fall of 1915 indicate that all available material will be disposed of by the end of the calendar year and that it will not be possible to supply the older stock for which there is a demand on account of the age of the nurseries.

LOUISVILLE NURSERY.

The Louisville nursery, as has been stated, was established in the fall of 1913. The size and capacity of the original planting has been increased each spring and fall since that time. In the fall of 1915 it is estimated that approximately two acres in the form of seed beds will be added to the present size of the nursery. The present stock on hand in the Louisville nursery consists of approximately 53,000 seedlings and transplants of the following species: catalpa (*speciosa*), black walnut, black locust, box elder, red oak, pin oak, black oak, burr oak, chestnut, buckeye, pecan, apricot, wild cherry, water maple, tulip poplar, Kentucky coffee tree, white hickory, shell bark hickory, gingko, white ash, sugar maple and English oak. There will be available for distribution this fall approximately 25,000 seedlings and transplants, chiefly of the following species: black locust, black walnut, box elder and catalpa. Even though this material is sold to citizens of the State at cost, a very material return will accrue to the State from the money invested. The land on which the Louisville nursery was established is situated along the Ohio River and was in an exceedingly poor condition at the time this work was undertaken. It has been necessary to build up the soil both by the addition of vegetable matter and by the use of limestone and acid phosphate. The ground at the present time begins to show very clearly the results of this soil building and the productivity so far as the nursery stock is concerned may be expected to increase very materially. The summer of 1913 was an unusually dry one and before the water system was finally installed the nursery felt very materially the lack of the proper amount of moisture. This water system consists of a tower and tank, a drilled well and pump operated by a gasoline engine. The capacity of the water system as at present installed is sufficient to supply the nursery for considerable time to come. It is the expectation that eventually the city water system will be extended so that the city water will become available. The initial cost of the water system was \$660. In addition a packing and storing house was found necessary for the proper handling of material for disposal and shipment. This was

erected at an initial cost of \$1,273.90. There has, therefore, been a large initial cost to the establishment of the nursery not only in the building up of the soil but also in the construction of a water system and the packing and storing facilities. It is expected that, as the amount of material produced at the nursery is increased, the cost of the material placed throughout the State may be very materially reduced. The Western Parkway has been extended through the nursery grounds and since the nursery is itself adjacent to the federal fish hatchery, not only do the fish hatchery and nursery in themselves become an important exhibit in connection with the State Fair, but become an attractive spot through all the year so far as the city of Louisville is concerned. It has been the endeavor in connection with the nursery to add to the attractiveness of the surroundings by making plantings of trees and improving the ground wherever possible without any very large additional expense. It has been possible on the nursery to raise enough rye and barley for the purposes of packing material for shipment. The things among the features needed at the nursery at the present time most urgently are a house for the nurseryman and a team which may be available at all seasons of the year, since it has been found difficult to obtain the necessary teams for plowing at times when they were most needed.

FRANKFORT NURSERY.

A small beginning at the Frankfort nursery was made in the fall of 1914. The material planted did very well. There is at the present time in this nursery 3,155 seedlings of the following species: red oak, chestnut, black walnut, white ash, sugar maple, shell bark hickory, pin oak, and yellow poplar. The capacity of this nursery will be increased in the fall of 1915 by the addition of one acre of seed beds. In connection with work on the Frankfort nursery it will be necessary to fence the grounds in actual use and in the fall of 1915 to erect a small house for the storing of tools, seeds and other supplies used in connection with the work.

SEEDS.

The supply of seed for both the Louisville and Frankfort nurseries was originally obtained by purchase from sources outside the State. In a great many instances this proved unsatisfactory since the stock was not in the condition most desirable. In the fall of 1914 and spring of 1915, a good share of the seed planted was obtained by collection within the State and the supply planted in 1915 will be almost entirely secured in this way since it has been demonstrated at the nursery at Louisville that material obtained within the State is a great deal more satisfactory and the percentage of germination very much higher. The gathering of the seed within the State promises to develop a new industry which may be pursued with profit by a considerable number of individuals not only for the supply of the demand within the State and at the State nurseries but for shipment outside the State as well.

EXPERIMENTAL FOREST.

In connection with the nursery at Louisville there has been established on a small portion of the ground adjacent to the Ohio River an Experimental Forest. This forest will serve two purposes. Not only will it form a permanent exhibit at the State Fair of how a small woodlot may be established and successfully handled in accordance with the best forestry principles and practice; but it will also serve to hold the bank of the river at this point from caving in and will in addition form an attractive feature of the landscape.

SPECIALTIES.

The raising of fruit trees for distribution through the State is one thing which the forest nursery is attempting both because of the growth of the orchard business in recent years in Kentucky and because that there is a demand throughout the State of standard species at a moderate cost. The State forest nurseries were in better position to undertake this work than any other

State agency at the present time. In addition there is also growing up a demand for trees to plant along the public highways, especially in view of the fact that the good roads movement has assumed such an important role within the State in the last two years. In the nursery at Louisville especial attention will be given to having on hand the character of material which may be planted to advantage along the public roads. Nut trees of various sorts have been especially suggested in this connection as well as fruit trees. It is pointed out in this regard that not only do trees along the public roads serve the purpose of furnishing valuable shade and, in the case of nut and fruit trees, a valuable product, but they also add materially to the longevity of the road itself.

LIBRARY.

There is being gathered together in the office of the State Forester what is in all probability the best library in regard to forestry and related subjects in the State. At the present time this consists of approximately eight hundred books, reports, bulletins and pamphlets and the number is being continually increased.

PURCHASE OF LAND UNDER THE WEEKS LAW IN KENTUCKY.

It was recommended in the First Biennial Report of the State Forester that a law be passed by the General Assembly, enabling the Federal Government to purchase certain lands within the Commonwealth of Kentucky for the purpose of creating a national forest reserve. This law was passed at the session of the General Assembly of 1914, S. B. No. 76, Bosworth, Chapter 24, Acts of 1914, Kentucky, "An act to give consent by the State of Kentucky to acquisition by the United States of such lands as may be needed for the establishment of a national forest reserve in said State." It was approved March 17, 1914. This act is as follows:

Be It Enacted by the General Assembly of the Commonwealth of Kentucky:

WHEREAS, It is proposed that the Federal Government establish in the high mountain regions of Kentucky and adjacent States a national forest reserve, which will perpetuate these forests and forever preserve the headwaters of many important streams, and which will thus prove of great and permanent benefit to the people of this State; and Whereas, a bill has been introduced in the Federal Congress providing for the purchase of such lands for said purpose, the General Assembly of Kentucky do enact:

Section 1. That the consent of the State of Kentucky be, and is hereby, given to the acquisition by the United States, by purchase or gift or by condemnation according to the law, of such lands in the mountain region of Kentucky as in the opinion of the Federal Government may be needed to the establishment of such a national forest reserve in that region: PROVIDED, That the State shall retain a concurrent jurisdiction with the United States in and over such lands so far that civil process in all cases, and such criminal process as may issue under the authority of the State against any person charged with the commission of any crime without or within said jurisdiction, may be executed in like manner as if this act had not been passed: AND PROVIDED, That in all condemnation proceedings the rights of the Federal Government shall be limited to the specific objects set forth by the laws of the United States in regard to forest reserves.

Section 2. That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition as hereinbefore provided, for incorporation in said national forest reserves, of such mountain lands lying in Kentucky as in the opinion of the Federal Government may be needed for this purpose.

Section 3. Power is hereby conferred upon Congress to pass such laws and to make, or provide for the making of such rules and regulations, of both civil and criminal nature, and provide punishment therefor, as in its judgment may be necessary for the management, control and protection of such lands as may be from time to time acquired by the United States under the provisions of this Act.

Section 4. That all laws and parts of laws in conflict herewith are hereby repealed.

The Weeks Law, which was passed by the Federal Congress March 1, 1911, provides for the acquisition of forest lands on the watersheds of navigable streams. Its purpose is to promote and protect the navigability of the streams by preserving the forest on the upland portions of their watersheds. Through this act means is afforded of extending the national forest system to

regions where the Government has hitherto owned no forest lands and taken no direct part in forest preservation.

The original appropriation was \$2,000,000 per year for five and one-half years beginning with the last half of the fiscal year 1911. The Agricultural Appropriation Bill for the fiscal year 1913 made the appropriation for 1912 and subsequent years available until expended. As originally provided for in the law there was an appropriation of eleven million dollars. Three million of this lapsed, however, on account of the fact that the law was not passed soon enough to allow land to be appraised before the annual appropriation lapsed. The remaining balance of the eight million dollars which was available is now so small that it must be largely used for the acquisition of lands necessary to block in tracts which have already been approved for purchase. This will bring the present purchase areas in good shape for administration and fire protection. The acreage, however, which has already been approved for purchase is small when the entire area of rough mountain land is considered. Moreover, there are several states in which no purchases have been made on account of the fact that enabling acts permitting the purchase of lands by the United States were not passed in time by the State legislatures. Kentucky is among these states. It is expected that an increased appropriation will be requested of Congress at the coming session in order to complete the purchase of additional lands which should be acquired.

Immediately upon the passage of the act enabling the Federal government to purchase lands in Kentucky for national forest purposes, the office of the State Forester took up with the office of acquisition in the Forest Service at Washington, the proposition of having lands in Kentucky examined with the view to their suitability for national forests. In response to this request, an examination went forward during the summer of 1914, with a result that approximately 500,000 acres was recommended for purchase when the examination had been completed. One of the areas recommended for purchase is in the Pine Mountain region, including the Pine Mountain fault and a part of the Harlan County Pine

Mountains, also including some of Letcher, all of Leslie and extensive parts of Clay County. An additional area was recommended along the Bluegrass border.

It will be necessary for Congress to appropriate additional funds for these purposes, but there seems no doubt but what the work already begun in this direction will be carried out and the necessary additional appropriation will be made. On these areas, as on others, as soon as the purchase of them is assured to the Federal government, an administrative force will be installed, including a supervisor and rangers, to look after and protect the areas and prevent trespass and to open up the areas for the use of all the citizens. One of the first of the plans for such administration will be to outline a system of roads and trails whereby the resources of the national forests may be made available to the public as has been done on the national forests of the West. In addition to these roads and trails which will act as a means for fire protection, a system of telephones will be installed and lookout stations arranged for in order that a thorough system of fire patrol may be initiated and forest fires prevented entirely, if possible. Twenty-five per cent of all receipts of revenues from national forests created in any State go to the county within which the national forest exists for the maintenance of roads and schools in and adjacent to such national forests. An additional 10 per cent is spent directly by the Federal government for the building of roads within such national forests.

RECOMMENDATIONS OF THE STATE FORESTER

GENERAL.

It is recommended:

1. That the endeavor to secure publicity for the work of the State Forestry department and the benefits incident to a fixed forest policy in Kentucky be continued as heretofore, especially in the common schools of the State.

2. That lands be purchased in the State upon which a practical demonstration of the application of forest principles through the management of timber and wood-

lands may be put into operation, since lands can be purchased at a very little figure at this time. The consummation of such purchases within the next few years is earnestly recommended. Two tracts should be provided for, one in Eastern Kentucky and one in Western Kentucky.

3. That the Louisville nursery be made more efficient by the purchase of a team and wagon and by the erection of a house for the occupancy of the nurseryman.

4. That the system of fire protection already inaugurated be continued and enlarged as far as the funds of this department permit; and that activities in this direction especially contemplate the providing of an adequate system of lookout towers with telephone communication between such towers and important towns and centers, looking to the securing of more prompt notice when fires occur.

5. That the erection of a building at the State Fair through the funds and material to be contributed by lumbermen and timberland owners and the wood-using industries of the State be secured, if possible, in order that a permanent exhibit of the forest products and wood using industries of Kentucky may be made.

6. That definite investigative work be undertaken, first with regard to the streams and water supply of the State, and second with regard to the consumption of timber in the mining industries.

LEGISLATION.

It is recommended:

1. That the forest law be changed so that it is made a felony to set fire to any woods, brush, forest, logs, leaves, or grass so as to damage or destroy tree growth upon adjacent property whether the property of the individual who sets the fire, or otherwise.

2. That the State law be further changed so that one-half the balance of all fines and penalties collectable under the provision of the act after the payment of the percentage of fines allowed by law to other public officers shall be paid to the county forest warden or other persons appointed by the State Board of Forestry, sheriff

or his deputy, constable or his deputy or peace officer, or any private citizen securing the apprehension and conviction of individuals under this law.

3. That the State law be further amended so that all money received from the sale of stock and material from the State Forest nurseries be paid into the treasury to the credit of the forest reserve fund.

4. That definite laws be enacted with relation to forest taxation, so that the reforestation of waste lands and cut-over lands suitable for raising forest crops may be encouraged and placed on a sound business basis, and that such legislation embody the following features:

a. Taxation of the land separate from the forest crop by annual tax fixed during a period of years.

b. Taxation of the forest crop at the time of maturity by assessing the crop at a certain reasonable per cent of the then market value.

c. Necessary machinery for carrying out the purport of the law.

5. That the present forest law be amended to permit co-operation with the Federal government to the extent of \$5,000 instead of \$3,000.

LIST OF FEDERAL AND STATE PATROLMEN APPOINTED IN THE FALL OF 1915.

J. S. Arnett.....	Wolfe County
H. C. Black.....	Rowan County
Jeff Canady	Knox County
Sam E. Caudill	Elliott County
Lewis Chilton	Todd County
Roy Coleman	Pike County
S. G. Combs.....	Clay County
D. M. Cress, Jr.....	Rockcastle County
Ed Dick	Clinton County
A. H. Hamlin.....	Rockcastle County
J. R. Hicks.....	Menifee County
O. A. Holbrook.....	Morgan County
M. E. Howard.....	Harlan County
H. H. Howard.....	Harlan County
John W. Hudgeons.....	Caldwell County
M. W. Huffaker.....	Wayne County
T. H. Hyden.....	Leslie County
Ernest Jayne	Johnson County

A. T. Keen.....	Pulaski County
Arch Lutes	Lee County
J. C. Newberry.....	Martin County
W. M. Parker.....	Bell County
James E. Pigg.....	Laurel County
E. P. Rader.....	Jackson County
J. El Runyon.....	Pike County
J. L. Smith.....	Livingston County
J. H. Sellards	Floyd County
W. J. Stander.....	Lewis County
David Stephens	Magoffin County
Robert Strong	Jackson County
G. M. Wheeler.....	Morgan County
James Winn	Estill County

ARBOR DAY PROCLAMATION.

"I, James B. McCreary, Governor of the Commonwealth of Kentucky, do issue this proclamation, designating Friday, November 12, 1915, as ARBOR DAY for the Commonwealth of Kentucky, and request its observance by the planting of trees and such other exercises as may be deemed proper.

"The attention of all the people, and especially the teachers and pupils of all the colleges and schools, is called to this proclamation, and the importance of planting trees. Every proper effort should be made for the renewal of our forests. Other States are giving much attention to Arbor Day, and there has been great development in the last decade along forestry lines. I call upon the people to give more attention to the observance of Arbor Day in Kentucky than has been given heretofore. The students of all the colleges should take an active interest in the setting out of trees, and the pupils of every common school in the State can render great service by each of them setting out one or two trees on Arbor Day.

"School houses, home yards, public roads and pastures should be beautified with trees. Our natural forests are diminishing, and we must not only save what is left of the forests, but we must reforest the cut-over, the burnt-over and the unforested districts of the State.

"In testimony whereof, I have caused these letters to be made patent, and the seal of the Commonwealth to be hereunto affixed. Done at Frankfort, the twenty-seventh day of October, in the year of our Lord one thousand nine hundred and fifteen, and in the one hundred and twenty-fourth year of the commonwealth.

“(Signed) JAMES B. MCCREARY,

(Seal)

Governor.

“By the Governor.

C. F. Crecelius, Secretary of State.

By Guy Vansant, Assistant Secretary of State.”

ARBOR DAY.

The observance of Arbor Day for the planting of trees has become a fixed institution in the life of Kentucky. The official observance of this day has become pretty well established in the fall, in the early part of November, and this year November 12 has been designated by the Governor as the official Arbor Day. In some localities, however, the desire to plant trees in the spring has given rise to the observance of an Arbor Day at this season of the year, and, although it has not been officially recognized, it is an exceedingly good plan. Observing a day for the special purpose of planting trees at this time of year would largely suit the climatic conditions and the convenience of the neighborhood in which the planting is to be done. The observance of Arbor Day has been confined to a large extent to the schools and is one of the best means of inculcating in the minds of the boys and girls both the beauty and the utility of tree growth. The reasons for planting trees may be briefly stated as follows: First, the perpetuation of the forests and tree growth as one of the greatest resources of the State; second, the beauty which they add to any landscape from the purely scenic point of view. Either of these reasons is sufficient incentive for increasing forest planting throughout Kentucky.

One of the greatest movements which has been started throughout the United States at the present time and which is being emphasized in Kentucky at the moment is the planting of trees along the public highways. At the present time a large number of excellent roads are being constructed and the attention of the school children and those interested in the observance of Arbor Day is directed to this movement in order that the work undertaken on Arbor Day may serve some useful purpose and be a distinct benefit in the political life of the State.

FINANCIAL STATEMENT

STATE BOARD OF FORESTRY—FISCAL YEAR 1914.

Beginning July 1, 1913, and ending June 30, 1914.

1913

7/1	Geo. Fetter	\$ 3.50	\$ 3.50
7/7	Guy Barrett	8.85	12.35
7/15	Harry B. Towles	30.00	42.35
7/15	Expense Account (JEB)	39.40	81.75
7/31	Jos. N. Zoeller (salary)	75.00	156.75
7/31	Payroll (July)	283.33	440.08
8/12	Cumberland Tel. & Teleg. Co.....	3.45	443.53
8/12	Frankfort Home Tel. & Teleg. Co.....	2.50	446.03
8/31	Expense Account (JEB)	30.40	476.43
8/31	Expense Account (Maury)	5.10	481.53
8/31	H. A. Gretter	33.00	514.53
8/31	Jos. N. Zoeller (salary)	75.00	589.53
8/31	Payroll (August)	283.33	872.86
9/2	T. E. Cornell	69.75	942.61
9/2	Fred Gans	18.00	960.61
9/2	Hall Seed Co.....	73.20	1,033.81
9/2	Albrecht-Heick Hdwe. Co.....	4.10	1,037.91
9/5	Hardwood Record	6.00	1,043.91
9/8	Fred Gans	36.00	1,079.91
9/8	T. E. Cornell	40.65	1,120.56
9/8	Cumberland Tel. & Teleg. Co.....	6.95	1,127.51
9/15	Geo. G. Fetter	28.77	1,156.28
9/22	Expense Account (Buford)	36.55	1,192.83
9/24	Frankfort Home Tel. & Teleg. Co.....	2.50	1,195.33
9/30	Payroll (September)	358.33	1,553.66
10/2	Adams Express Co.....	10.02	1,563.68
10/5	Expense Account (JEB)	22.77	1,586.45
10/6	Expense Account (Kastle)	10.20	1,596.65
10/6	Cumberland Tel. & Teleg. Co.....	3.35	1,600.00
10/8	Frankfort Home Tel. & Teleg. Co.....	2.50	1,602.50
10/8	Albrecht-Heick Hdwe. Co.....	1.90	1,604.40
10/14	Jos. N. Zoeller (salary)	75.00	1,679.40
10/16	Expense Account (JEB)	11.00	1,690.40
10/17	Geo. L. Barnes (stamps)	25.00	1,715.40
10/18	Expense Account (Buford)	29.75	1,745.15
10/18	Ky. State Journal	79.73	1,824.88
10/31	Payroll (October)	508.33	2,333.21
11/1	Expense Account (Maury)	9.90	2,343.11
11/1	Expense Account (JEB)	20.35	2,363.46

11/5	Crutcher Bros.	21.50	2,384.96
11/5	Frankfort Home Tel. & Teleg. Co.....	2.50	2,387.46
11/5	Cumberland Tel. & Teleg. Co.....	7.05	2,394.51
11/8	State Journal	3.58	2,398.09
11/11	Payroll (Temp. Laborers)	9.26	2,407.35
11/14	Expense Account (JEB)	11.82	2,419.17
11/24	Expense Account (Price)	45.49	2,465.66
11/24	Expense Account (Price)	19.13	2,483.79
11/24	Expense Account (JEB)	65.40	2,549.19
11/26	Payroll (Temp. Laborers)	5.00	2,554.19
11/26	J. F. McKinney	2.50	2,556.69
11/28	Payroll (Temp. Laborers)	28.00	2,584.69
11/29	Payroll (November)	508.33	3,093.02
12/2	Payroll (Temp. Employees)	18.25	3,111.27
12/3	Expense Account (Price)	32.29	3,143.56
12/4	Cumberland Tel. & Teleg. Co.....	8.38	3,151.94
12/4	H. S. Gretter	9.50	3,161.44
12/5	State Journal	52.66	3,214.10
12/9	Frankfort Home Tel. & Tel. Co.....	2.50	3,216.60
12/18	Expense Account (Price)	41.60	3,258.20
12/20	Expense Account (JEB)	12.40	3,270.60
12/22	Payroll (Temp. Laborers)	360.00	3,630.60
12/24	Payroll (December)	508.33	4,138.93
1914			
1/2	Expense Account (Buford)	57.32	4,196.25
1/2	Expense Account (Price)	13.00	4,209.25
1/5	Cumberland Tel. & Teleg. Co.....	3.75	4,213.00
1/5	Frankfort Home Tel. Co.....	2.50	4,215.50
1/6	Bullock Lumber Co.....	68.45	4,283.95
1/6	Geo. L. Barnes (stamps)	25.00	4,308.95
1/8	Geo. G. Fetter	2.10	4,311.05
1/8	Kentucky Nursery Co.....	10.00	4,321.05
1/10	Tinsley, Mayer Engraving Co.....	90.00	4,411.05
1/26	Expense Account (JEB)	17.75	4,428.80
1/30	Expense Account (Mackoy).....	75.16	4,503.96
1/31	Payroll (January)	508.33	5,012.29
2/4	Expense Account (Buford)	39.52	5,051.81
2/6	Cumberland Tel. & Teleg. Co.....	4.99	5,056.80
2/6	State Journal	4.86	5,061.66
2/13	Frankfort Home Tel. Co.....	2.50	5,064.16
2/14	Expense Account (JEB)	26.63	5,090.79
2/24	Louis Carrico	1.60	5,092.39
2/24	F. M. Crayton & Sons.....	3.80	5,096.19
2/28	Payroll (February)	508.33	5,604.52
3/3	Central Clipping Bureau	2.50	5,607.02
3/4	Cumberland Tel. Co.....	8.26	5,615.28
3/6	Strassel-Gans Paint Co.....	9.60	5,624.88

3/10	Expense Account (JEB)	19.10	5,643.98
3/11	State Journal	13.89	5,657.87
3/18	Frankfort Home Tel. & Teleg. Co.....	2.50	5,660.37
3/19	Geo. L. Barnes (Stamps)	25.00	5,685.37
3/25	Payroll (Temp. Laborers)	48.00	5,733.37
3/28	Geo. L. Barnes (Stamps)	15.00	5,748.37
3/31	Payroll (March)	508.33	6,256.70
4/1	Central Clipping Bureau	2.50	6,259.20
4/3	Cumberland Tel. & Teleg. Co.....	3.70	6,262.90
4/3	State Journal	315.14	6,578.04
4/3	Payroll (Temp. Laborers)	20.00	6,598.04
4/6	State Journal	4.95	6,602.99
4/10	G. G. Fetter	12.90	6,615.89
4/11	Expense Account (JEB)	40.16	6,656.05
4/13	Frankfort Home Tel. Co.....	2.50	6,658.55
4/16	A. H. Stamper	22.10	6,680.65
4/20	Wiley Rice	4.30	6,684.95
4/20	Expense Account (JEB)	17.60	6,702.55
4/21	Expense Account (Price)	41.07	6,743.62
4/22	Payroll (Temp. Laborers)	22.50	6,766.12
4/22	G. R. Hughes (Stamps)	25.00	6,791.12
4/25	Expense Account (Maury)	9.65	6,800.77
4/29	Payroll (Temp. Laborers)	26.00	6,826.77
4/30	Payroll (April)	508.33	7,335.10
5/1	Mrs. J. E. Barton (Salary)	17.50	7,352.60
5/1	Southern Lumberman	15.00	7,367.60
5/1	Central Clipping Bureau	2.50	7,370.10
5/4	Expense Account (Price)	39.05	7,409.15
5/4	Albrecht Sons Hdwe. Co.....	2.50	7,411.65
5/4	Payroll (Temporary Laborers).....	25.50	7,437.15
5/4	Payroll (Temporary Laborers).....	60.00	7,497.15
5/4	Payroll (Temporary Laborers)	32.88	7,530.03
5/5	Payroll (Temporary Laborers).....	74.25	7,604.28
5/7	J. P. Will Co.....	60.00	7,664.28
5/8	State Journal	121.52	7,785.80
5/8	Cumberland Tel. & Teleg. Co.....	8.84	7,794.64
5/8	Expense Account (JEB)	20.70	7,815.34
5/8	Payroll (Temp. Laborers)	25.50	7,840.84
5/16	Expense Account (JEB)	37.26	7,878.10
5/18	Expense Account (Price)	45.52	7,923.62
5/18	J. P. Will Co.....	27.53	7,951.15
5/18	Hall Seed Company	2.60	7,953.75
5/21	Payroll (Temp. Laborers)	16.50	7,970.25
5/21	Hagan Gas Engine & Mfg. Co.....	140.00	8,110.25
5/21	Belknap Hdwe. & Mfg. Co.....	35.48	8,145.73
5/22	McCreary Co. News Co.....	3.40	8,149.13
5/22	Frankfort Home Tel. & Teleg. Co.....	2.50	8,151.63

5/25	Iring Transfer Co.....	5.02	8,156.65
5/27	J. P. Will Co.....	5.81	8,162.46
5/27	Payroll (Temp. Laborers)	24.00	8,186.46
5/27	John Baisely	38.00	8,224.46
5/30	Payroll (May)	645.83	8,870.29
6/1	Expense Account (Price)	56.00	8,926.29
6/1	Expense Account (JEB)	69.19	8,894.48
6/5	F. W. Kelsey Nursery Co.....	58.50	9,052.98
6/5	Expense Account (JEB)	19.82	9,072.80
6/5	Cumberland Tel. & Teleg. Co.....	5.34	9,078.14
6/5	Payroll (Temp. Laborers)	45.12	9,123.26
6/6	Albrecht Hdwe. Co.....	15.75	9,139.01
6/6	G. G. Fetter	15.75	9,154.76
6/15	Payroll (Temp. Laborers)	510.00	9,664.76
6/15	Expense Account (JEB)	55.08	9,719.84
6/15	Frankfort Home Tel. & Teleg. Co.....	2.80	9,722.64
6/15	Expense Account (Price)	18.85	9,741.49
6/15	Expense Account (Kastle)	4.10	9,745.59
6/15	Louisville Transfer Co.....	3.00	9,748.59
6/22	Belknap Hardware Co.....	2.00	9,750.59
6/27	Belknap Hardware Co.....	230.00	9,980.58
6/30	Central Clipping Bureau	5.00	9,985.59
6/30	Payroll (June)	695.87	10,681.46
7/13	Payroll (Temp. Laborers)	6.25	10,687.71
7/17	Cumberland Tel. & Tel. Co.....	8.45	10,696.16
7/17	Expense Account (JEB)	31.95	10,728.11
7/17	Payroll (Temp. Laborers)	23.75	10,751.86
7/20	Payroll (Temp. Laborers)	32.00	10,783.86
7/20	Frankfort Home Tel. & Teleg. Co.....	2.50	10,786.36

**STANDARDIZED DISTRIBUTION OF THE EXPENDITURES OF
THE OFFICE OF THE STATE FORESTER.**

Beginning July 1, 1913, and ending June 30, 1914.
Fiscal Year 1914.

1. Salaries—			
Fire Protection	\$1,600.00		
Nursery	900.00		
Misc. Exec.	3,567.50		
			\$6,067.50
2. Wages—			
Nursery	\$ 226.40		
Fire Protection	1,388.76		
			1,615.16
3. Traveling Expenses—			
Fire Protection	\$ 515.14		
Misc. Exec.	673.57		
			1,188.71

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4. Transportation of Materials—		
Nursery	\$ 10.69	
Misc. Exec.	33.52	
		44.21
5. Communication		221.06
7. Advertising, Printing and Binding—		
Fire Protection	\$ 3.40	
Misc. Exec.	728.83	
		732.23
8. Equipment: Office		78.27
9. Equipment: Field—		
Fire Protection	\$ 28.90	
Nursery	772.82	
		801.72
10. Miscellaneous		37.50
		<u>\$10,786.36</u>

DETAILED EXPENDITURES AT STATE FOREST NURSERY, LOUISVILLE.

Fiscal Year 1914.

Labor	\$ 24.00	
Freight, Hauling, etc.....	11.69	
Tools, Equipment, etc.....	83.23	
Materials—		
Seed	\$138.50	
Other	172.59	311.09
Plowing		202.65
Water System		660.00
Salaries		900.00
		<u>\$2,192.66</u>

STATEMENT OF RECEIPTS AND EXPENDITURES OF THE BOARD OF FORESTRY FOR FISCAL YEAR 1915.

Beginning July 1, 1914, and ending June 30, 1915.

7/1 Belknap Hardware Company	\$ 7.68	\$ 7.68
7/13 G. R. Hughes (Stamps)	50.00	57.68
7/13 Payroll (Temp. Laborers)	30.00	87.68
7/17 Payroll (Temp. Laborers)	39.75	127.43
7/17 Payroll (Temp. Laborers)	15.00	142.43
7/17 J. E. Barton (Expense Account).....	78.15	220.58
7/20 E. B. Lynch	700.00	920.58
7/25 State Journal	3.90	924.48
7/31 Payroll (July)	733.33	1,657.81
8/1 J. E. Barton (Expenses)	34.40	1,692.21
8/1 G. R. Hughes (Stamps)	25.00	1,717.21

8/1	Standard Oil Company	10.50	1,727.71
8/13	State Journal	3.84	1,731.55
8/17	John Bassler	74.25	1,805.80
8/17	Frankfort Home Tel. & Tel. Co.....	3.35	1,809.15
8/17	Harry Jones (Expenses)	33.55	1,842.70
8/17	J. E. Barton (Expenses)	59.00	1,901.70
8/17	Laib Company	65.92	1,967.62
8/17	Albrecht Sons Hardware Company.....	5.85	1,973.47
8/17	G. R. Hughes (Stamps)	50.00	2,023.47
8/18	Payroll (Temp. Laborers)	12.50	2,035.97
8/18	Cumberland Tel. Company	13.16	2,049.13
8/20	Hall Seed Company	7.20	2,056.33
8/24	Central Clipping Bureau	2 50	2,058.83
8/24	Central Clipping Bureau	2.50	2,061.33
8/24	J. P. Will Company	6.60	2,067.93
8/24	Payroll (Temp. Laborers)	26.00	2,093.93
8/24	E. B. Lynch	300.00	2,393.93
8/29	J. E. Barton (Expenses)	36.66	2,430.59
8/31	Payroll (August)	658.33	3,088.92
9/1	E. B. Lynch	213.25	3,302.17
9/2	H. F. Price (Expenses)	10.05	3,312.22
9/3	Cumberland Tel. & Tel. Co.....	3 83	3,316.05
9/4	Scott Lamb	145.18	3,461.23
9/5	Mason Maury	60.65	3,521.88
9/8	J. E. Barton (Expenses)	22.89	3,544.77
9/8	Harry Jones (Expenses)	30.35	3,575.12
9/9	State Journal	16.32	3,591.44
9/22	Frankfort Home Tel. & Tel. Co.....	2 50	3,593.94
9/22	H. F. Price (Expenses)	12.30	3,606.24
9/26	Louis Crabtree (Expenses)	18.00	3,624.24
9/30	J. E. Barton (Expenses)	57.81	3,682.05
9/30	Payroll (September)	733.33	4,415.38
10/1	Louisville Transfer Co.....	4 50	4,419.88
10/1	Payroll (Temp. Laborers)	34.00	4,453.88
10/1	H. F. Price (Expenses)	12.55	4,466.43
10/1	John Bassler	27.00	4,493.43
10/1	The Crutcher Bros. Co.....	48.82	4,542.25
10/1	Louisville Hay & Grain Co.....	13.25	4,555.50
10/2	Central Clipping Bureau	2.50	4,558.00
10/2	Frankfort Transfer Company	1.95	4,559.95
10/3	Cumberland Tel. Co.....	4 86	4,564.81
10/5	Harry Jones (Expenses)	24.20	4,589.01
10/7	J. E. Barton (Expenses)	25.15	4,614.16
10/7	Frankfort Home Tel. Co.....	2 50	4,616 66
10/9	Frank Kavanaugh	1.00	4,617.66
10/10	Scott Lamb (Expenses)	27.32	4,644.98
10/10	G. R. Hughes (Stamps)	25.00	4,669.98

10/13	Payroll (Temporary Laborers)	39.75	4,709.73
10/13	Geo. G. Fetter	46.40	4,756.13
10/14	Kentucky Nursery Company	10.00	4,766.13
10/14	State Journal	10.37	4,776.50
10/15	James Patterson	12.50	4,789.00
10/15	Saunders Express	5.00	4,794.00
10/15	Al Piers	6.00	4,800.00
10/22	Harry Jones (Expenses)	46.34	4,846.34
10/29	Scott Lamb (Expenses)	30.10	4,876.44
10/31	Payroll (October)	791.41	5,667.85
11/2	Payroll (Fire Wardens)	306.00	5,973.85
11/3	Payroll (Temp. Laborers)	35.25	6,009.10
11/3	Payroll (Temp. Laborers)	17.50	6,026.60
11/3	Cumberland Tel. & Tel. Co.....	9.04	6,035.64
11/3	B. R. Bacon Hdwe. Co.....	3.00	6,038.64
11/3	Central Clipping Bureau	2.50	6,041.14
11/3	H. F. Price (Expenses)	18.46	6,059.60
11/4	Frank Carrico	6.83	6,066.43
11/5	Frankfort Home Tel. Co.....	2.50	6,068.93
11/5	Somerset Journal	3.00	6,071.93
11/6	State Journal	1.71	6,073.64
11/10	Payroll (Temp. Laborers)	9.00	6,082.64
11/13	Payroll (Temp. Laborers)	54.00	6,136.64
11/13	G. R. Hughes (Stamps)	50.00	6,186.64
11/14	Payroll (Temp. Laborers)	43.51	6,230.15
11/17	J. E. Barton (Expenses)	18.65	6,248.80
11/18	Payroll (Temp. Laborers)	49.70	6,298.50
11/18	Payroll (Temp. Laborers)	14.75	6,313.25
11/18	Payroll (Temp. Laborers)	25.45	6,338.70
11/20	Harry Jones (Expenses)	54.86	6,393.56
11/21	H. F. Price (Expenses)	30.10	6,423.66
11/21	C. D. Arnett (Expenses)	26.05	6,449.71
11/23	Payroll (Temp. Laborers)	7.00	6,456.71
11/25	John Kleber	40.50	6,497.21
11/25	John Bassler	49.50	6,546.71
11/25	J. E. Barton (Expenses)	22.05	6,568.76
11/25	Payroll (Temp. Laborers)	11.64	6,580.40
11/25	Payroll (Temp. Laborers)	13.15	6,593.55
11/27	Merchants Transfer & Storage.....	3.00	5,596.55
11/30	Payroll (State Wardens)	488.00	7,084.55
11/30	Payroll (Temp. Laborers)	15.00	7,099.55
11/30	Payroll (November)	808.33	7,907.88
12/1	H. F. Price (Expenses)	39.35	7,947.23
12/2	Capital Lumber & Mfg. Co.....	8.70	7,955.93
12/2	Payroll (Temp. Laborers)	43.87	7,999.80
12/3	State Journal	27.50	8,027.30
12/9	B. R. Bacon Hdwe. Co.....	8.20	8,035.50

12/17	Frankfort Home Tel. Co.....	2.50	8,038.00
12/17	Cumberland Tel. Company	9.85	8,047.85
12/17	Albrecht Sons Hdwe. Co.....	.70	8,048.55
12/17	R. M. Parish	15.00	8,063.55
12/17	Louisville Hay & Grain Company.....	2.50	8,066.05
12/18	J. E. Barton (Expenses)	83.43	8,149.48
12/18	Harry Jones (Expenses)	42.90	8,192.38
12/18	H. F. Price (Expenses)	18.45	8,210.83
12/22	Payroll (Temp. Laborers)	25.14	8,235.97
12/22	Payroll (Temp. Laborers)	31.25	8,267.22
12/22	Payroll (Temp. Laborers)	43.77	8,310.99
12/22	Payroll (Temp. Laborers)	108.50	8,419.49
12/22	Payroll (Temp. Laborers)	352.25	8,771.74
12/22	Payroll (Temp. Laborers)	37.60	8,809.34
12/23	Payroll (State Wardens)	158.00	8,967.34
12/31	F. W. Kelsey Nursery Co.....	33.92	9,001.26
12/31	Payroll (December)	808.33	9,809.59
1915			
1/5	Frankfort Home Tel. Company.....	2.50	9,812.09
1/5	Cumberland Tel. Company	7.56	9,819.65
1/5	Central Clipping Bureau	5.00	9,824.65
1/8	Chesapeake & Ohio Ry. Co.....	16.76	9,841.41
1/20	J. B. Speed & Co.....	4.75	9,846.16
1/26	Payroll (Temp. Laborers)	61.30	9,907.46
1/30	Payroll (January)	808.33	10,715.79
2/1	Central Clipping Bureau	2.50	10,718.29
2/1	Frankfort Home Tel. Co.....	2.50	10,720.79
2/4	Cumberland Tel. & Tel. Co.....	3.10	10,723.89
2/4	State Journal	2.03	10,725.92
2/5	Geo. G. Fetter	8.00	10,733.92
2/8	J. E. Barton (Expenses)	26.18	10,760.10
2/13	Harry Jones (Expenses)	27.90	10,788.00
2/25	J. E. Barton (Expenses)	28.60	10,816.60
2/25	The Sun Publishing Company	1.00	10,817.60
2/27	Payroll (February)	808.33	11,625.93
3/1	G. G. Fetter	21.30	11,647.23
3/1	Payroll (Temp. Laborers)	12.00	11,659.23
3/2	Central Clipping Bureau	2.50	11,661.73
3/3	Cumberland Tel. Company	3.95	11,665.68
3/4	Frankfort Home Tel. & Teleg. Co.....	2.50	11,668.18
3/4	National Bank of Commerce .....	.85	11,669.03
3/15	Payroll (Temp. Laborers)	9.50	11,678.53
3/17	J. E. Barton (Expenses)	48.48	11,727.01
3/27	J. E. Barton (Expenses)	31.34	11,758.35
3/31	Payroll (March)	808.33	12,566.68
4/1	Central Clipping Bureau	2.50	12,569.18
4/1	Henry Towery (Expenses)	54.57	12,623.75

4/2	Payroll (County Warden)	90.00	12,713.75
4/3	Cumberland Tel. & Teleg. Co.....	6.46	12,720.21
4/3	Frankfort Home Tel. & Teleg. Co.....	2.50	12,722.71
4/7	Payroll (Temp. Laborers)	11.50	12,734.21
4/12	J. E. Barton (Expenses)	18.25	12,752.46
4/12	Harry Jones (Expenses)	40.37	12,792.83
4/19	H. F. Price (Expenses)	20.15	12,812.98
4/27	J. E. Barton (Expenses)	43.33	12,856.31
4/28	Harry Jones (Expenses)	33.54	12,889.85
4/28	Payroll (Temp. Laborers)	28.95	12,918.80
4/30	Payroll (April)	808.33	13,727.13
5/1	Central Clipping Bureau	2.50	13,729.63
5/4	Cumberland Tel. & Teleg. Co.....	6.37	13,736.00
5/5	State Journal	3.45	13,739.45
5/6	G. R. Hughes (Stamps)	10.00	13,749.45
5/12	Frankfort Home Tel. Co.....	2.50	13,751.95
5/13	J. E. Barton (Expenses)	23.05	13,775.00
5/26	J. E. Barton (Expenses)	28.55	13,803.55
5/29	Payroll (May)	583.33	14,386.88
6/3	G. G. Fetter Co.....	4.50	14,391.38
6/3	Cumberland Tel. & Teleg. Co.....	2.75	14,394.13
6/4	Central Clipping Bureau	2.50	14,396.63
6/9	Laib Co.	11.84	14,408.47
6/9	Harry Jones	26.85	14,435.32
6/9	J. E. Barton	21.43	14,456.75
6/9	Frankfort Home Tel. & Teleg. Co.....	2.50	14,459.25

**STANDARDIZED DISTRIBUTION OF EXPENDITURES OF THE
OFFICE OF THE STATE FORESTER FOR
FISCAL YEAR 1915.**

Beginning July 1, 1914, and ending June 30, 1915.

1. Salaries—		
Fire Protection	\$3,310.18	
Nursery	1,333.08	
Misc. Exec.	3,941.63	
		\$ 8,584.89
2. Wages—		
Fire Protection	\$2,206.08	
Nursery	256.40	
		2,462.48
3. Traveling Expenses—		
Fire Protection	\$ 682.36	
Misc. Exec.	694.29	
		1,376.65
4. Transportation of Materials		98.29
5. Subsistence—		

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6. Communication		309.48
7. Advertising, Printing and Binding—		
Fire Protection	\$ 1.00	
Misc. Exec.	72.97	
		73.97
8. Equipment: Office		81.20
9. Equipment: Field—		
Nursery	\$1,413.79	
Misc. Exec.	10.00	
		1,423.79
10. Miscellaneous		48.50
Grand total		\$14,459.25

DETAILED EXPENDITURES AT STATE FOREST NURSERY,
FRANKFORT.

Fiscal Year 1915.

Tools	\$ 3.00	
Materials—		
Seed	\$ 6.83	
Other	16.90	
		23.73
Salaries	508.08	
		\$534.81

DETAILED EXPENDITURES AT STATE FOREST NURSERY,
LOUISVILLE.

Fiscal Year 1915.

Labor	\$ 4.50	
Tools, Equipment, etc.....	75.02	
Materials—		
Seed	\$ 59.97	
Other	38.82	
		98.79
Plowing	191.25	
Construction	1,273.90	
Salaries	825.00	
		\$2,468.46

STATEMENT OF RECEIPTS IN THE OFFICE OF THE
STATE FORESTER.

Fiscal Year 1915.

Receipts from the sale of 1,000 black locust seedlings.....	\$ 3.00
100 catalpa seedlings .....	.75
Total	\$ 3.75

EXPENDITURES UNDER THE WEEKS LAW.

The agreement between the Federal Government under the Weeks Law became effective October, 1913. Expenditures under this agreement are made according to the calendar year and must be made entirely for the salaries of patrolmen and lookout watchmen in accordance with the terms of the agreement. The expenditures to date are as follows:

Calendar year 1913 (approx. 3 months).....	\$1,068.00
Calendar year 1914	3,944.00
Calendar year 1915 (to Sept. 30).....	1,622.00

THE LOCUST BORER

(*Cyllene robiniae*)

AND OTHER INSECT ENEMIES OF THE BLACK LOCUST

BY H. GARMAN,

Entomologist and Botanist of the Kentucky Agricultural
Experiment Station.

The most serious handicap to the successful growing of black locust is the attacks of an insect belonging to the family commonly known as long-horned wood borers and in entomological writings as Cerambycidae. Its family contains many troublesome pests, mostly attacking trees of different sorts by boring in their trunks. The round-headed apple tree borer (*Saperda candida*) is a similar insect; the elm borer (*Saperda tridentata*) is another; the basswood borer (*Saperda vestita*), still another. The cane borer of blackberry and the twig girdler, together with numerous other species, all represent the same family of insects as the one here treated. They are among the most difficult of insects to deal with, and represent to the forester what the chinch-bug, Hessian fly, cutworm and army worm do to the grower of field crops. Few of our native trees are entirely exempt from the attacks of one or another of these borers. But the black locust borer is in this State perhaps the most numerous beetle of its family. In the fall of the year the adults become common on certain flowers. None of the other wood borers in any situation is quite so numerous, although a red and black one is often seen about the flowers of milkweed and is an exception to the rule in the family as to its habits, attacking the stems and roots of milkweed instead of those of woody plants.

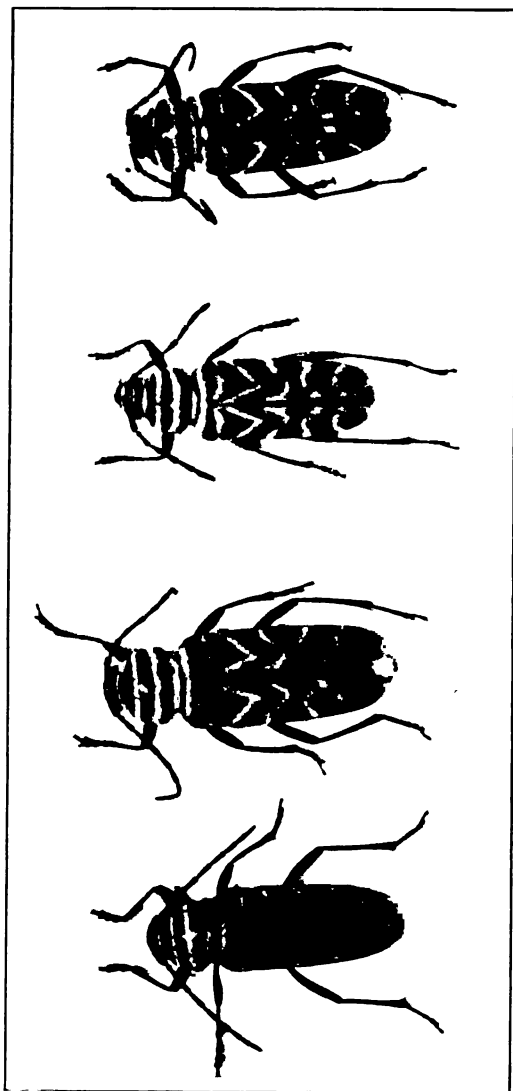


Fig. 1. Adult locust borers (X 2).



Fig. 2. A, B, C, and D, eggs of the locust borer, as they appear after being thrust by the beetles into crevices in the bark (X 2).

The adult locust borer is an active, slender, black beetle about 0.60 inch long, which may be found in September and October on the flowers of the common golden-rods, upon which it feeds. It is black, with a number of cross bands of yellow, one of those on the middle of the back being W-shaped. There is only one other beetle likely to be mistaken for it and this is the Hickory Borer (*Cyllene pictus*), which does not however frequent golden-rod, and comes out as an adult in the spring of the year. My figure, together with these statements, will enable any one to recognize the locust borer, and a more detailed description may be left for another section of this account. The beetles themselves do no harm to locust trees, and are not often observed about the trees unless one looks for them during the period of egg laying. The mischief is done by their young, legless, white grubs, with brown heads and strong jaws, which bore into the trunks of the trees.

NATURE AND EXTENT OF THE INJURY.

The burrows made by the grubs occur anywhere on the trunks of the trees from the ground up to the branches, and, contrary to my impression when I began to study their habits, extend out on the branches to where these are an inch and a half or thereabouts in diameter. It thus proves that no part of the tree above ground is free from attack except the new growth and the more slender branches. Trees may show dozens of the burrows, made at different seasons, so that neglected ones finally become riddled with burrows, though those of individual grubs remain independent commonly. The direct damage is severe enough to render trees worthless for posts, but if it were not followed by decay, might not result in the destruction of the trees. As a matter of fact, but few trees are killed outright, though they lose their branches, become knotted and stunted and simply remain breeding places for the beetles. Many trees kept about premises for shade are now in this condition. The locust is a very hardy tree, and even with its heart wood largely gone as a result of water admitted by the borers, it will stand for years, giving rise each season to a score or more of the beetles. The seriousness of the damage done becomes

more apparent to the man who tries to raise locusts for posts, or who buys posts and wants sound ones. With several burrows reaching in toward the center of a post in every foot or two of length, the life of a post is bound to be greatly shortened by decay, and the grower finds his profits cut down because of his inability to furnish sound posts.

There is no part of Kentucky, apparently, in which the borers are not present, and their numbers are in proportion to the abundance of locust trees. In Bluegrass Kentucky they are exceedingly common, and this statement applies to all that territory about Lexington, Paris, Covington, Frankfort, Shelbyville, Louisville, and westward to the Mississippi River, with locusts in some southern counties, for some unexplained reason, less injured than they are along the Ohio River. Eastward the injury becomes somewhat less also, and the adult borers are less often seen on the goldenrod. I have visited no part of the State, however, where the adult beetles were not found if the visit was made during the time when they are abroad, and my search for them this fall in mountain counties, where they are least common, showed them to be present in small numbers there.

Their local scarcity thus appears to be a matter of scarcity of the trees, and seems to be the condition that prevailed when the locust was only found growing wild in the forests. The planting of trees for shade about premises and along roadsides has doubtless been followed by a great increase in their numbers. Any general tendency to grow trees in a commercial way for posts is thus likely to be followed by a still further increase in the number of beetles unless we can find a means of lessening their numbers. The outlook appears unpromising, but I am stating the facts, since these are the only basis upon which success in producing locust posts can be based. If we cannot get rid of this injury, it is useless to talk of growing sound posts for the market.

INJURY TO LOCUST PLANTINGS MADE FOR THE PRODUCTION OF POSTS.

Already a few enterprising men in the State have started plantings with the object of producing posts, and part of these trees have now been examined by us to

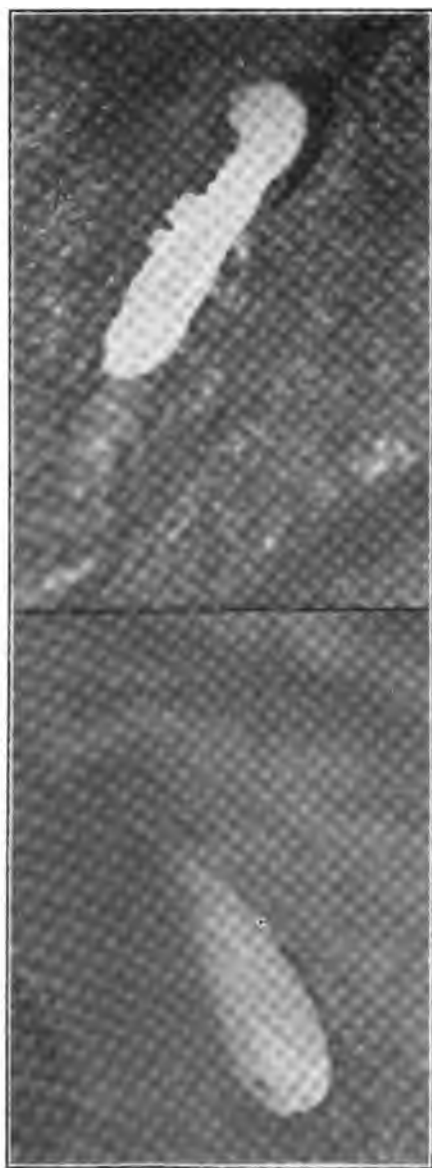


Fig. 3. Two eggs, greatly magnified
(X 18), in crevices of bark.

learn if possible the conditions under which injury is most severe. The trees will grow almost anywhere, a peculiarity which gives them an advantage over catalpa and other forest trees which might otherwise compete with them for favor. The poorest clayey hill will produce locust very well, whereas the planting there of catalpa would be a waste of time and money. As a matter of fact, black locust gathers nitrogen from the air and thus improves poor soils where other trees would deplete them. But poor land in which some of the Kentucky plantings have been made, is also likely to be surrounded by neglected land, and on neglected land the rank growths of Solidago (goldenrod) in the fall of the year furnish forage for the beetles. The injury is thus sometimes severe on such land, not because the trees are less well adapted to it, but because the other conditions favor the beetles. On good land with the surrounding region in close cultivation *the beetles are at a disadvantage in getting food during the period when they are out of the trees.* The fact here stated I consider one of the important ones learned by a study of the insect. It will be dwelt on later in discussing the food habits of the beetle.

THE OWENTON PLANTING.

One of the largest plantings known to me is located at Owenton in Owen County. The trees grow here naturally in perhaps as large numbers as anywhere in the State, and the conditions for growing trees in a commercial way are exceptionally good, excepting for the depredations of the beetles. Col. R. C. Ford has at his place perhaps a hundred acres planted in locusts. Some of the trees are now of a size suitable for fence posts, others are smaller, the range in age being from one to six years. The land is poor, badly washed and gullied in places, though the plantings have in part been made to stop this cutting up of the surface and the accompanying rapid washing away of the soil. Col. Ford thinks the trees have more than repaid the cost of planting in checking this removal of the surface.

Nearly all of the trees were found badly infested July 28-30, when examined by Mr. Jewett, of the Division, the older trees having suffered most. Isolated trees and

clumps growing along roadsides had suffered with the rest, and it was evident that the beetles had concentrated in the vicinity as the trees became numerous. Some difference in favor of trees growing near the bottom of slopes was noted, due probably to the better soil, which kept the trees in a better condition to withstand attack.

Some dead trees were noted, the result of drought, borers, and poor soil combined, but probably few or none were actually killed by the borers, though many of the trees showed dead branches which had evidently been killed by the insects. Trees which had been cut for posts were badly damaged by the burrows.

Trees from three to five inches in diameter were in every case damaged by borers. Those from two to three inches in diameter of trunk were less injured, the percentage being about fifty per cent. The youngest trees, of a season's growth, showed no injury and were thrifty in appearance. The instinct of the beetles seems thus to warn them that the seedlings are too small to afford sustenance to the larvae.

The young cut out of the trees at Owenton were well advanced in development, and the condition of the burrows showed that they were approaching the period of pupation. The holes always cut by the larvae just previous to becoming pupae had in some cases been made, from which it appears that the condition was much like that at Lexington at this time.

Other insects were doing little injury to these trees. The bag worm (*Thyridopteryx ephemeraeformis*) was common. Some leaf hoppers were collected. Leaf miners had been working on the leaves, but had at the time left their mines.

THE SHELBYVILLE PLANTING.

On August 14, 1914, a planting occupying about twenty-five acres of ground, and another of five acres, were examined on the premises of Mr. Frazier. The larger planting was twenty-seven years old, the trees ranging from five to eight inches in diameter of trunk, while those of the younger planting averaged about four inches.

The land was very badly gullied when planted, but at the present time the gullies are largely obliterated

through the influence of the trees, and has undoubtedly been improved by their presence otherwise. The only other trees noted in the neighborhood were scattered trees along the roads.

These trees appeared to be in much better condition than those examined at Owenton. The foliage was of good color and no dead trees were seen, though dead branches were sometimes observed on trees by the roadsides. Very little evidence of the presence of borers was found and the damage done seems not to be very severe. Fence posts were cut from the planting in 1913 to the value of \$1,200, and were only slightly damaged.

The reason for the immunity of these plantings as compared with others we have examined was not apparent and is yet to learn.

Young of the beetle taken from trees were changing to pupae or preparing to do so. The exit holes had been cut in the majority of cases, and the plug of shavings placed in the burrow above the insect.

PLANTINGS AT MORGANFIELD, UNION COUNTY,
OCTOBER, 2, 1914.

Mr. G. L. Drury at Morganfield has a planting occupying several acres which, with numerous trees growing in the vicinity, was examined October 2, 1914, by Mr. Niswonger. The region, like that at Owenton, seems exceptionally suited to black locust, and trees were found everywhere along roadsides, fence rows, creeks, etc. A small planting examined at this place appeared to have been completely killed by the insect, with the exception of the larger trees. On Mr. Drury's place the trees, averaging about three inches in diameter of trunk, were severely injured, some of them killed.

At Waverly, Kentucky, a planting of about seven acres was examined on the place of Mr. H. A. Roberts. The trees were planted in 1887 and ranged from six to eleven inches in diameter of trunk. The larger trees seemed to be little injured, but the young ones showed the exit holes made by beetles. Dead trees, of which a few were observed in this planting, appeared to have been injured by other agencies than the beetles. This planting had been grazed by sheep.

The adult beetles were found to be common on goldenrod in the locality, sometimes at a distance from trees, in one instance a half mile from the nearest observed tree. All about the small two-acre planting on Mr. C. F. Morehead's place, noted above as very badly injured, goldenrod grew in profusion and some plants were scattered among the trees. In fields and along roadsides also goldenrod was excessively common, and everywhere harbored large numbers of beetles. On the trees the beetles were ovipositing, and eggs were found hatching, while others had already given up the young. This was at eleven o'clock in the forenoon. About Mr. Drury's place, also, the goldenrod grew everywhere in adjacent fields and along roadsides. At 2:30 p. m. the beetles were noted running up and down the trees looking for places to conceal their eggs. At the same time large numbers were about the flowers, many of them mated.

On Mr. H. A. Roberts' place at Waverly the injury appeared to be less than in other plantings, a condition explained perhaps by the fact that his land was kept clear of weedy growths and the locust planting itself had been grazed by sheep. Few beetles were observed here, and very few goldenrod plants, a condition the reverse of the others examined about Morganfield.

Small trees planted at one edge of his farm had, however, been badly injured and in their vicinity goldenrod was common. Both trees and flowers bore numerous beetles at the time of Mr. Niswonger's visit.

ST. BERNARD COAL COMPANY PLANTINGS, AT CENTRAL CITY,
OCTOBER 3 AND 4, 1914.

At Central City several plantings, from a few acres to sixty in extent, were found to agree in general with those already mentioned. The beetles had done most mischief where goldenrod was most numerous and the injury diminished even on parts of one planting as the goldenrod became less common. A section near the railroad where goldenrod continues from year to year had been largely killed by the beetles and hundreds were observed on the flowers, twenty-five beetles being counted on one small clump of plants. The adults were observed

to be mating at eleven o'clock in the morning; eggs just hatching, others that had hatched were found, sometimes on dead trees.

A forty-acre planting at this place was found to correspond with those inspected elsewhere, in that where the open spaces occurred in which goldenrod was established the injury was always worst and in isolated sections where there was no goldenrod the trees were nearly perfect.

A LaGRANGE PLANTING.

October 6, 1914, a planting of two thousand black locusts at LaGrange was examined. It had been killed by fires. The trees were planted in 1903 and in some cases had a trunk diameter of four inches, though mostly less. The planting was badly infested with goldenrod, about half done blooming, upon which were found some beetles. A few mating beetles were noted (3-5 P. M.), and females were observed looking for places to deposit their eggs, on partly dead trees. The dead trees observed showed numerous marks of infestation.

SUMMARY OF EXAMINATIONS MADE IN 1914.

While the beetles fly like bees when disturbed and travel some distance to find food, it is evident from the work thus far done that there is a relation between the abundance of goldenrod and the prevalence of injury. Wherever a planting adjoins land on which goldenrod is exceptionally common the injury is severe. Wherever the planting is away from growths of goldenrod the injury is proportionately less. The insects certainly do most harm where the food plant upon which the beetle depends is most numerous, and this suggests the possibility of controlling the injury to a great extent by destroying this plant whenever it is seen in the vicinity of locust trees.

THE FOOD PLANTS OF THE ADULT BORER.

The important relation sustained by the goldenrods to locust injury in Kentucky led me to observe these plants more closely in 1915, with a view to learning what

species was most resorted to by the beetles. From the examinations made in 1914 it began to appear that one species of plant (*Solidago altissima*) furnished most, or all of the food taken by the adult beetles while their eggs were maturing. This has proved true in great measure as a result of observations made in 1915. The period during which the insects are out of the trees corresponds with remarkable closeness with the period of blooming of this common species. The beetles may be said to depend upon it for food. But, contrary to my first impression, they are not restricted to it. We have a species (*S. canadensis*) bearing a close resemblance to *S. altissima*, but with smaller heads of flowers and an earlier period of blooming, upon which the beetles first to emerge were found. But they were few in number, and the plant evidently is not an important forage for the insects, excepting as it may tide over the early maturing beetles until the more acceptable plant is in bloom. Still another species besides *S. canadensis* was observed to have attracted a beetle at Corbin, Kentucky, this fall, and a cultivated species with broad leaves (*S. rigida*?) obtained from the Henry Dreer Seed Company of Philadelphia, and kept during the past season at the Conservatory of the Division, attracted a few beetles. So it is evident that they get some food from other species of goldenrod at times, and would probably resort to any of the species in the absence of their favorite. I had supposed they were restricted for food to the genus *Solidago*, but this also seems not to be true. On one occasion at Lexington, Mr. Jewett, of the Division, found a beetle on a native plant with white heads of flowers (*Eupatorium serotinum*). It grows in wet ground about ponds and is one of the Joe-Pye weeds and a member of the same botanical family (Compositae) as the goldenrods. I have myself several times taken the beetles during the season of 1915 from another species of the genus (*Eupatorium perfoliatum*) known as Thorowort or Boneset. It also has white flowers. These plants are, however, not as generally scattered about fields as are the goldenrods and are thus of much less importance as food for the beetles. Their time of blooming comes very close to the period of emergence of the beetles.



Fig. 4. A number of eggs deposited under the bark in an old excavation (X 3).

I have had it reported to me that the beetles visit the flowers of the Marigold, an old-fashioned flower of our gardens. The statement seemed so contrary to what we know of the insect that I wished to verify the observation and see to what extent this exotic attracted these native insects. With this in view I had planted a number of varieties, both African and French, dwarf and tall, in a plot of ground near the Conservatory. They made a fine growth and produced a great wealth of flowers. Several species of *Solidago* were planted near them and a short distance away were some young locust trees to which some beetles were attracted. Adult beetles were present on the goldenrods throughout most of the period when the insects were abroad. I examined the marigolds repeatedly and did not find a single beetle on the flowers. Such beetles as visit these plants must, I think, be strays that have alighted during their wanderings in search of locust trees or of goldenrod.

In brief, the important food plant of the adult locust borer is one species of goldenrod, the *Solidago altissima*, already mentioned. Wandering beetles may alight on the flowers of other plants at times, but with the exceptions noted above this appears to be only temporarily. Asters and other flowers which were common in the immediate neighborhood of goldenrod this season were visited by large numbers of other insects, but in not a single case was a locust borer noted about them. On the other hand, any isolated clump of *Solidago altissima* was likely when in full bloom to be visited. A small clump in my yard was generally frequented by several of the beetles, day and night, during September.

THE FOOD AND FEEDING OF THE ADULT BEETLE.

The activity of the beetles about the flowers of goldenrod at once arouses one's curiosity as to what they get from the flowers, and why it should be necessary for them to feed so constantly after they emerge from the trees. They are as industrious as bees and almost as active, eating away steadily, but dropping to the ground, or taking wing quickly, when approached. An examination of the contents of the alimentary canal throws light on this subject: The part of the flower eaten is the pollen,

and they are thus rivals of the bees in collecting this nutritious food. The beetles mature but slowly after they cast the pupal skin in their burrows, and remain for a long period without food, the body white and soft, the colors gradually appearing and the crust becoming harder, until about the time the goldenrod begins to bloom, the first ones come out, the numbers rapidly increasing until in late September when they may be found wherever there are *locust trees and goldenrod*. Without the two, one to provide food for the larva, the other for the adult, this insect would probably not long continue abundant.

It seems to me, therefore, that the general destruction of goldenrod in the vicinity of locust plantings will lessen the injuries of the beetles, if it does not entirely prevent it. For it is evident that this plant furnishes the stimulating food necessary for the development of the eggs of the female; and as a matter of fact I find that beetles confined without food of this character soon die, while those provided with it live and place eggs on the bark of sections of locust trees furnished them.

LIFE-HISTORY OF THE LOCUST BORER.

After mating, the beetles begin to resort to the locust trees for the placing of their eggs. Eggs may be found on the bark of trees about the middle of September. In 1914, they were found in some numbers September 17. The females run up and down the trunks and larger branches, searching for suitable crevices in which to hide the eggs, generally placing them well under loose bark, but often leaving one end, or in some cases the larger part of the length exposed. They are scattered about indiscriminately anywhere on the trunk and larger branches, and may be found on some of the latter which are only an inch and a half in diameter. The greater smoothness of the bark on small branches seems to deter the placing of eggs to some extent, and the majority are ordinarily found on the trunk where they can be better concealed. Sometimes a half dozen or more eggs may be placed close together, as shown in one of my figures. By September 22, egg-laying is most



Fig. 5. Eggs, greatly magnified (X 18).

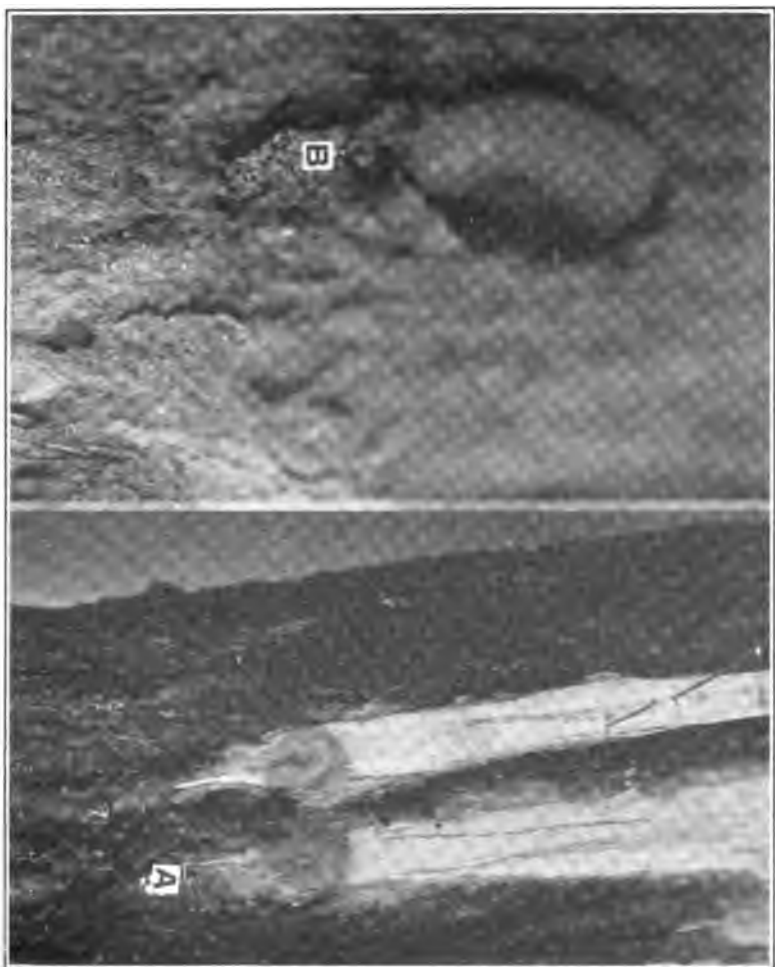


Fig. 6. A, a borer exposed in the fall of the year, the bark having been stripped off, turned over and pinned at one side; natural size; B, a young borer, soon after it has penetrated the bark; greatly magnified (X 12).

active, and in the middle of the day numerous beetles can be seen running about the trees engaged in this task.

Eggs were observed hatching on September 25, but the beetles were still numerous on goldenrod and continued so until the middle of October, and eggs were observed hatching as late as October 1. Many eggs are placed on trees subsequent to this date, however. On October 4, 1914, near Versailles in Woodford County, I found beetles still common on goldenrod, and from 11 A. M. until 1:30 P. M., observed them placing their eggs on the trunks of locust trees.

They were observed again. October 22, 1915, near Frankfort, on goldenrod, but were less common at this date than in 1914, because of a couple of early frosts which had destroyed most of the goldenrod.

As soon as hatched the young grub bores into the outer bark, throwing out refuse as it burrows, so that the point of entrance can generally be detected. It does not go very deep in the fall of the year, simply penetrating the outer bark and making a small oval cavity next the wood where it ceases boring and lies torpid during the winter months. Some of the burrows at this stage are represented in one of my figures.

With reference to the condition in which the young borer passes the winter, the following entries in my notes on the life-history may be quoted:

Nov. 17, 1914. Our first really cold weather began last night. The adults and *Solidago* disappeared some time ago. A piece of young tree about $3\frac{1}{2}$ inches in diameter examined today. The eggs on the bark were marked earlier in the fall. Young are few in number and have not penetrated as deeply as was expected. Three were discovered just beneath the outer corky layer of bark, the cavities in which they lay being scarcely larger than the bodies of their respective grubs. One cavity measures 4.3 millimeters (0.132 inch) in length and 2^{mm} (0.08 inch) in diameter. The grub measures 2.6^{mm} or about 0.10 inch in length. These little chambers are marked by a yellow stain outside each, due to the presence of the grub, probably to some secretion it produces, and which softens the wood, preparing it for more rapid appropriation by the weak mandibles and probably ren-

dering it more digestible. This yellowed wood extends about 3.4^{mm} outward in all directions from the cavity. The little grub lies not more than 3^{mm} (0.12 inch) from the outer surface of the bark.

Grubs torpid; move scarcely at all when the burrow is opened.

December 21, 1914. Numerous burrows were uncovered today in a section of a tree brought in from out-of-doors. All the grubs had stopped just under the rough bark and had only made cavities sufficient to accommodate their bodies. It is evident that they do not feed much as grubs in the fall.

WHEN THE GRUBS BECOME ACTIVE IN THE SPRING.

The real work of mining the tree and feeding begins, with the grub, in early spring, as soon as the trees themselves become active and the temperature rises. On April 29, 1915, larvae taken from the trees were found to have made but little headway since the preceding fall. They were becoming active, however, and an example in a branch about three-fourths inch in diameter had penetrated to an old burrow where it had grown much more rapidly than the rest. The great majority uncovered at this date were not much larger than they were in the fall. The stained region about the burrows has by this time extended somewhat and the discoloration is of a deeper brown color, so that burrows are quickly visible on stripping off the outer bark. A typical example measured to the outer limits of the stained region 20^{mm} (0.80 inch) by 8^{mm} (0.32 inch). These stained regions were elliptical or oval in shape, the stained wood beginning to break away at the edges from the living wood outside. The region has a peculiar sour odor at this time, due to some fermentative action set up either by the secretions of the grub or by bacterial organisms introduced by it from outside. As already stated the stain appears as soon as the recently hatched grubs reach the inner bark, and extends on all sides as the insect grows.

By June 15 the grubs have made shallow burrows beneath the corky layer of bark measuring from about 0.60 to 0.80 inch in diameter, with a depth of about 0.20



Fig. 7. Locust borers; natural size and enlarged.

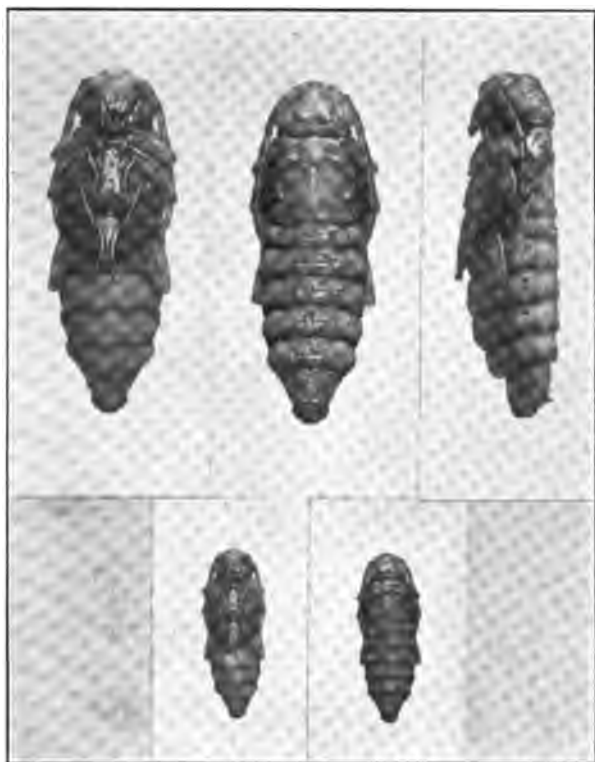


Fig. 8. The pupae of the locust borer; natural size and enlarged.

inch. Then at the upper end of this cavity it bores upward and inward toward the center of the trunk, in small trees reaching the center, then descending in the heart wood for a distance of about three inches. As refuse accumulates in the inner descending limb of the burrow it is pushed upward and over the bend to fall into the outer chamber made by the young larva. Ordinarily the grubs do not leave the descending limb of the burrow after it is made. The inner burrow is nearly uniform in diameter but may increase a little toward the lower end, where it measures in an example before me 0.40 inch. In large branches and in the trunks of trees the burrows do not reach the center, and in most of those examined the descending part runs downward parallel with the surface and just about an inch from the surface of the wood.

When sections of this wood were brought indoors from June 15 to June 20 the larvae continued active in them for some time, and as they lay on my table the slight noise made by their gnawing operations could be heard constantly, while a small heap of particles gradually accumulated on the table beneath each burrow. The drying out of these sections had the effect of hurrying the transformation of the grubs, however, and on June 29 in one instance a piece of branch about 18 inches long in which were several larvae, ceased to give forth refuse, and it became evident that the grubs were either dead or had begun to pupate. On cutting into the burrows July 11, it was found that in one was a pupa but it was dead. It was about 0.72 inch from the bottom of its burrow, and was protected from marauders from outside by a plug of loose chips made by the grub previously, and by another of dust-like particles filling the bend a half inch above. The whole burrow in this case was small, measuring 2.16 inches deep and 0.14 inch in diameter. In exposing this burrow I cut into the lower end of another above it, at one side of the first and not exactly in the center of the branch. The lower one followed the center. This upper burrow contained a larva preparing to pupate. Its burrow was closed above with chips and dust, but it had not yet molted. A plate glass was sealed over this second burrow so that it might

be observed. It pupated in the night of July 2, and was found in this condition July 3.

A singular feature of the habits was observed at this time and has since proved to be constant for the insect. These grubs, it is to be remembered, have never been outside the tree since they hatched from the egg. They are not supposed to know anything of adult locust borers, having never seen or in any other way received knowledge of this stage of their development, yet each borer cuts through the wood at the highest point in the burrow straight to the outside, so that the future beetle into which it will later develop can easily get out of the tree, and without having to descend, even if the burrow were large enough for the purpose, into the small chamber made by the young grub during the fall and early spring. Here, as in many other insects, is an illustration of something like prevision, foresight, call it what you will; and it becomes the more remarkable when you refuse to ascribe to these animals a mind and capacity to think. What is it that tells these grubs that the adult beetle will be unable to escape from the burrow unless the way is prepared for it by the strong jaws of the grub?

On July 23, 1914, the insect over which the plate of glass was sealed, was found to have become adult, but its body was still soft and it was below the plug of chips. On July 25 it was still below the plug, but when examined August 2, had pulled the plug into the bottom of its burrow and was in the upper part. It was out August 5, and was a small individual, having evidently been dwarfed by the drying of the wood, and its development accelerated.

On August 1, 1914, larvae out-of-doors had begun to make plugs in their burrows preparatory to entering upon the quiescent pupa stage. On August 10 both larvae and pupae were found in the burrows of living trees, on cutting into them, but the pupae were not numerous, and it was evident from their numbers that this is the time when pupation normally takes place.

Adults were not observed in the trees until September 2, when examples were found in the burrows, still soft and pallid. They were not observed out of the bur-



Fig. 9. A section of a badly injured young locust tree.

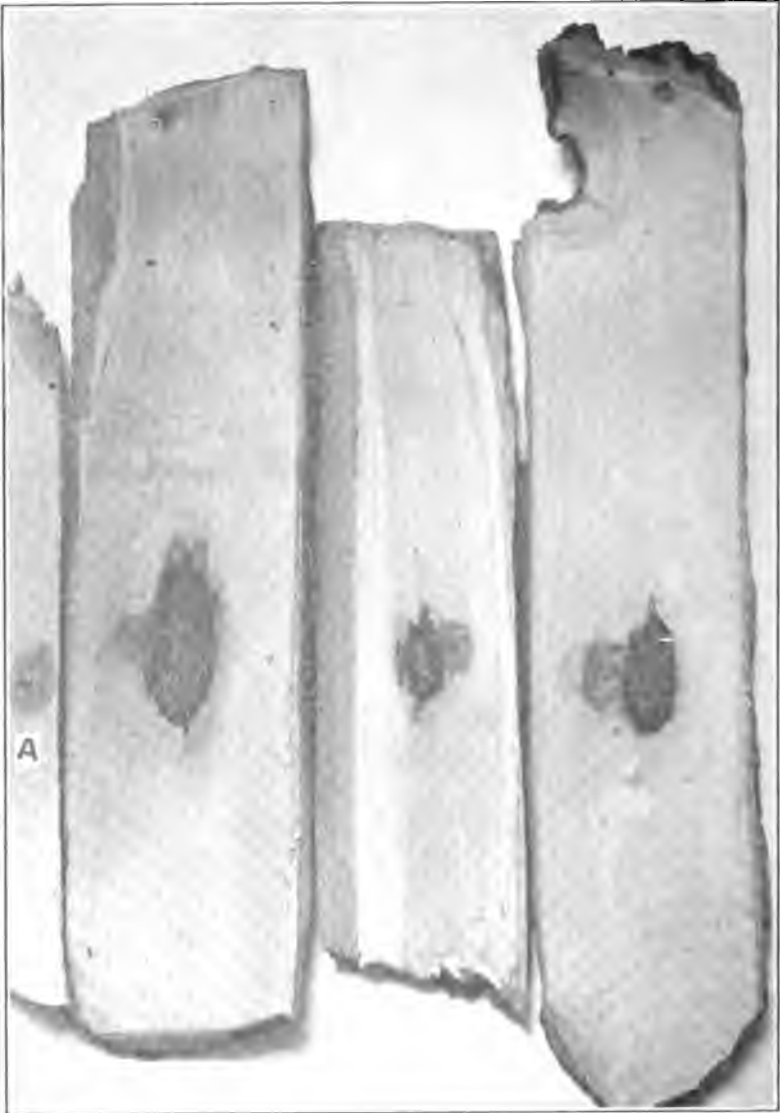


Fig. 10. Strips of locust bark removed to show cavities made by young borers; A, cavity as it appears in the fall; the rest as they appear in the spring (April).

rows and on *Solidago* until September 12, when both males and females were observed on the flowers.

This completes the round for a season; the egg-laying having already been mentioned as beginning about the middle of September, and continuing until cold weather approaches.

THE APPEARANCE OF INFESTED TREES.

Old trees about the streets of cities are sometimes so badly riddled by the borers that the trunk becomes unsymmetrical and rough while many of the branches are reduced to stubs and the rest greatly reduced in size, so that the crown is small and out of proportion to the diameter of the trunk. When cut into, such trees are found to bear the marks of boring by generation after generation of beetles, beginning at the center where they were injured when young, and extending out to the bark. Quite often the center and large cavities elsewhere are eaten out by decay also, yet such trees persist, wrecks as they are, year after year, silent testimony to the wonderful vitality of the species and the surprising durability of its wood. In most of the more closely peopled sections of the State wherever locusts have been planted in any number this is the condition in which many of the trees exist. Examination of shade trees about Lexington shows that from 50 to 100 per cent. is infested, most of them badly so. A tree about six inches through at the base and about twenty-five years old (the center was decayed a little so as to prevent an exact determination of the age), growing on the Experiment Farm, was stripped of its bark, June 15-20, from the ground up to the branches and then out on the branches as far as injury could be detected. It was found to be injured by the borers from the ground to and upon the branches until the latter became less than about 1.33 inches in diameter, after which the burrows were no longer present. The injury was greater at the bases of the branches than on the trunk of the tree, and this accounted for the numerous dead branches, while the body still retained enough vitality to produce foliage on the small branches.

The position of burrows was always apparent at this time because of the refuse consisting of bits of wood

and the like thrown from their entrances as well as by the sap which exudes at this season of the year. The apertures were always small, however, and quite often the bits seemed to have been thrown out by a small ant which takes up its domicile in the deserted burrows and was frequently observed in the shallow excavation made by the young borers just under the bark. Single burrows cause no serious injury to a tree. Trees with only a few would undoubtedly recover and present finally no outward signs of injury. It is the continued work of the insects year after year that finally shows its injurious effect, leaving the wood honeycombed with burrows and eaten away with the decay that follows them.

DESCRIPTIONS OF THE LOCUST BORER.

Egg.—Elongate, cylindrical, rounded or slightly truncate at one end, more pointed at the other. Smooth, opaque, white. Length, .092 inch; diameter, .032 inch.

Larva.—Cylindrical in general shape, widest just behind the head, the divisions well marked, about six of them protuberant at the sides. Head medium in size, brown about the bases of the appendages, elsewhere largely white, but with dark sutures beneath and a median dot above at the hind margin. When ready to pupate, the head may be largely brown. Division of body following the head widest, the second and third small, the size gradually increasing backwards to the tenth, then suddenly diminishing, the last being smallest and only about half the diameter of the one preceding it. Nine brown spiracles along each side, the front largest and out of line with the rest. Everywhere with fine, brown, microscopic pubescence, except on certain prominences along the back and on the under side, which are smooth. Four obscure pale brown spots are more or less visible above on the division immediately behind the head. No legs. General color white. Length of a fresh example about ready to pupate, 1 inch; greatest diameter .26 inch. A larva recently hatched measured .09 inch in length and .04 inch in greatest diameter. In general shape they are much like older larvae. They are quite helpless when removed from the burrow,



Fig. 11. The outer excavations made by borers under the bark before they penetrate the trunk. They bore into the tree at the upper edge of these shallow outer cavities; natural size.

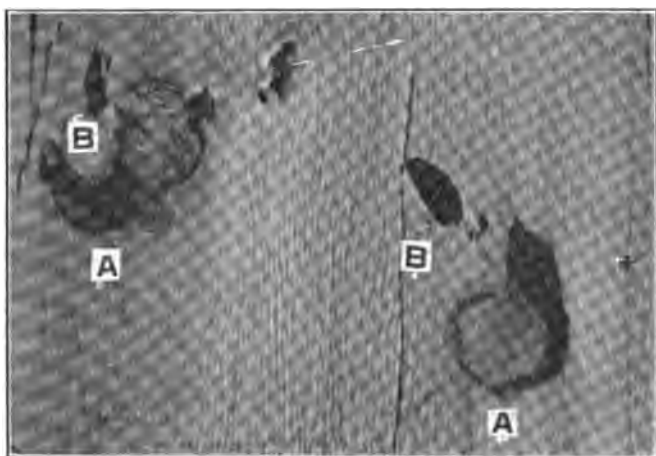


Fig. 12. A, A, two excavations of borers that are ready to pupate, the holes for the exit of the beetles being cut at B, B; natural size.

Pupa.—Oval in general shape, the legs, wings, antennae and other parts of the adult being outlined, but folded against the body. On the back of the thorax and abdomen are small brown prickles, these being larger and more conspicuous behind. Color white, or yellowish, a faint line along the middle of the back. Length .97 inch.

Imago (Adult).—The beetle is a slender cylindrical insect with moderately long legs and antennae. Length from about .50 to .80 inch, the males averaging smallest. Black, with cross bands of bright yellow, of which the third on the wing covers is W-shaped.

The only other beetle likely to be mistaken for it is the hickory borer (*Cyllene pictus*), which is marked with yellow bands in the same pattern, but has longer legs, the reddish thighs, reaching to the tips of the wing covers, and the second division of the hind tarsi being smooth beneath, whereas the same division of the feet of the locust borer is pubescent. The adult hickory borer is found only in the spring, when it is attracted to the bleeding stumps of trees that have recently been cut down.

ENEMIES OF THE LOCUST BORER.

A common insect like this, living as an adult exposed in the bright sunlight, would naturally be expected to serve as food for birds and predatory insects. The number of enemies thus far observed by us is small. The adult beetles are pretty well concealed when on the flowers of goldenrod by their yellow and black colors, which harmonize with those of the flowers much better than would be expected from an examination of the insect alone. I have not observed birds molesting them at any time. A disagreeable odor which they emit when handled may be an additional protection. The hard bodies of the beetles probably saves them from the attacks of most predatory insects. The larvae and pupae living within the burrows are completely sheltered from most enemies. I suspect that the wood is too hard for the beaks of woodpeckers, the only birds at all calculated to reach them.

A single large puncturing insect, the wheel bug (*Prionidus cristatus*) has proved a very effective check on the adult beetles, and where it is sufficiently common destroys them in large numbers. This insect is one of

the most formidable of its kind. It is a member of the order Hemiptera, a group containing such pests as the notorious chinch-bug, the squash bug, the bed bug and the kissing bug. It reaches a length of 1.28 inch, is provided with a stout beak, and gets its common name wheel bug from a toothed and arched crest on the back just behind the head. Individuals have been observed on the flowers of goldenrod destroying the locust borer adults, and also on the trunks of locust trees, where they may be observed with the beetles impaled on their beaks. On one occasion near McKee in Woodford County, I found an example with a beetle still struggling on its beak. With the wound it inflicts the bug injects a clear fluid that probably has a paralyzing effect. On one occasion an example taken from a goldenrod, managed while I was occupied momentarily with something else, to prod my finger, causing a sharp pain and subsequent inflammation and swelling, the results being somewhat like that of a bee sting.

The females when captured sometimes emit at the hind end of the body a forked, orange-colored, glandular body with a pungent scent like that of the gland of a celery butterfly. It is probably protective. The bottle-shaped eggs of this bug are placed in clumps on the twigs, and remain in this condition over winter. They are laid in September.

These wheel bugs are doing a great deal of good in some localities, and should be recognized and protected where this is practicable by those interested in the growing of locusts.

Adult locust borers dying in confinement are sometimes partly covered by a white fungus which emerges at the articulations between the divisions of the body. It may prove to be one of the parasitic fungi such as destroy the chinch-bug and other insects, but has not been studied carefully. From the free life led by the adults they are not so much exposed to the attacks of such fungi as are insects living concealed in moist situations.

OTHER INSECTS INFESTING THE WOOD OF LOCUST TREES.

Several other insects are found in the burrows of the locust borer, some of them appearing to be pretty constant guests in the outer parts of burrows and especially

in the old cavities. The small ant has already been mentioned. The larva of a small beetle is also frequently seen, and seems to be the young of a sap-lover, and one of the Nitidulidae. The egg-cases of roaches are sometimes found in the refuse of old cavities communicating freely with the exterior. A small gray beetle of the same family as the locust borer (*Cerambycidae*) has been occasionally found in the old burrows, and sometimes on the bark of the trunk.

Some examples of the Carpenter Moth (*Prionoxystus robiniae*) have been encountered by me in opening up the burrows of the locust borer. One of them brought in July 6, measured two inches in length, with a diameter of 0.44 inch. These big worms are more formidable in appearance than the grubs of the borers. They are yellowish white, with a series of poorly defined brown spots along each side of the back, and another lower down on each side. The head is deep chestnut brown, becoming blackish about the mouth. It can quickly be distinguished from the borer by the presence of three pairs of jointed legs just behind the head, no trace of such appendages being visible on the locust borer grub. The adult of the carpenter worm is a moth, and it thus belongs to an entirely different insect order (*Lepidoptera*).

It would be possible to give a long list of insects that attack the wood, living or dead, but it would only cumber this paper and serve no useful purpose. There are, however, several species in Kentucky besides the Locust Borer (*Cyrtene robiniae*) and the Carpenter Moth (*Prionoxystus robiniae*) already mentioned, that do some mischief at times and are of interest to the grower of young trees.

The Twig Miner (*Ecdytolopha insiticiana*). Perhaps the most important enemy of nursery trees is a small moth whose young bores into and mines the twigs of young trees. It has been found this year on a planting made by the State Forester at Louisville, and is constantly injurious to young trees about Lexington. The injury may commonly be recognized by an elongate swelling of the twig, with an opening at the lower end, between two thorns, from which protrudes a mass of

refuse which has been thrown from the burrow by its occupant. Some of the mines show no swelling of the twig, but in such cases their location can be recognized by the mass of refuse. The interior of such twigs is mined lengthwise by a small yellow, or, finally, bright crimson larva, with a reddish brown head and a blackish brown neck-plate just behind it. It moves quickly, and when ready for the next change comes out of the mined twig and roams about looking for a place to form a cocoon in which to lie during the pupa stage. In confinement most of them made odd little oval cases by cutting out pieces of two leaves lying in contact, fastening them together with silk and undergoing the change within. They lie for a long time in these cases as larvae, however, assuming finally the bright crimson color mentioned above. Most of them failed to emerge, but in two cases adult moths appeared, one from the cocoons, the other from sand and rubbish in the bottom of the rearing jar. Some of the larvae which made cases for pupation in the latter part of August were still unchanged September 4. One of the adults secured came out September 8, leaving the pupa skin protruding from the case.

Several broods appear to develop during a season. At any rate, after the brood secured in August as larvae had all emerged for pupation, and I supposed the winter would be spent in the adult or egg stage, young larvae were again found in the trees. In October, near Duncan, in Franklin County, these young larvae were quite common. We have not yet had an opportunity to learn just where and in what condition this late brood passes the winter.

Treatment for this pest consists simply in cutting out and burning the infested twigs. They can be so readily seen that this procedure involves no great difficulty. Spraying early in the season with arsenate of lead may be suggested also, since it is as reasonable to suppose that this treatment will be as effective as it is for the codling moth of apple. It remains to be tested, however.

Agrilus egenus.—A second insect that attacks the wood is to be mentioned here because of its constant

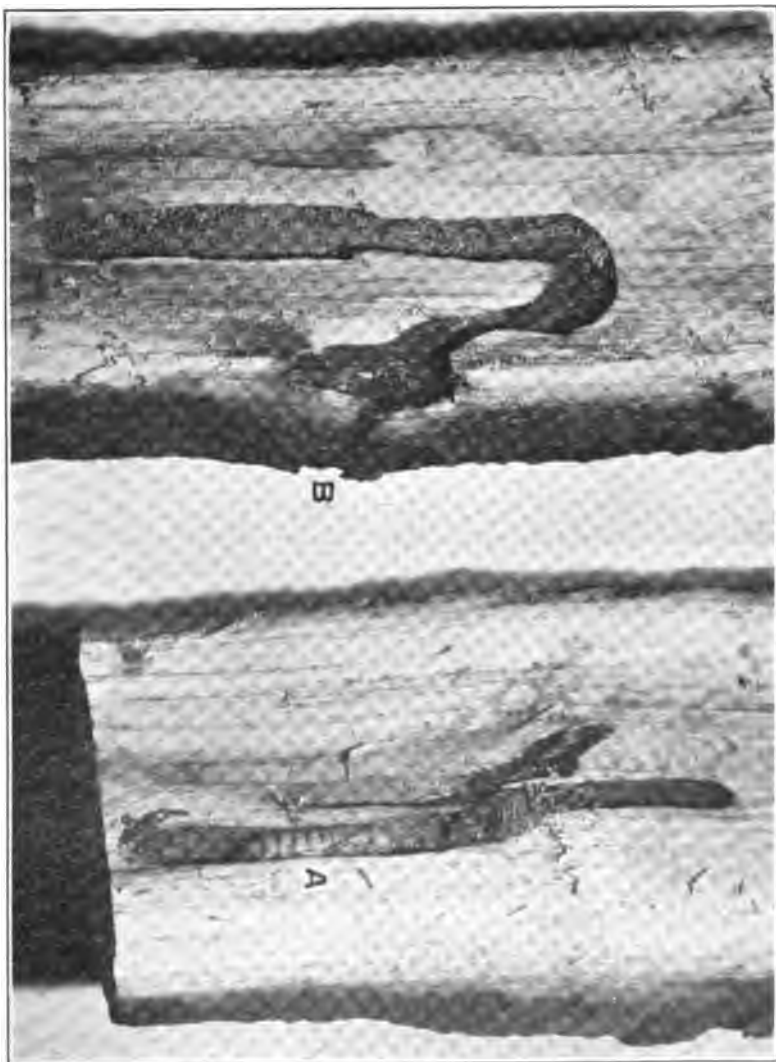


Fig. 13. Longitudinal sections of trees, showing burrows; A, the pupa beneath the plug of shavings; B, a complete burrow, the entrance opposite B; natural size.

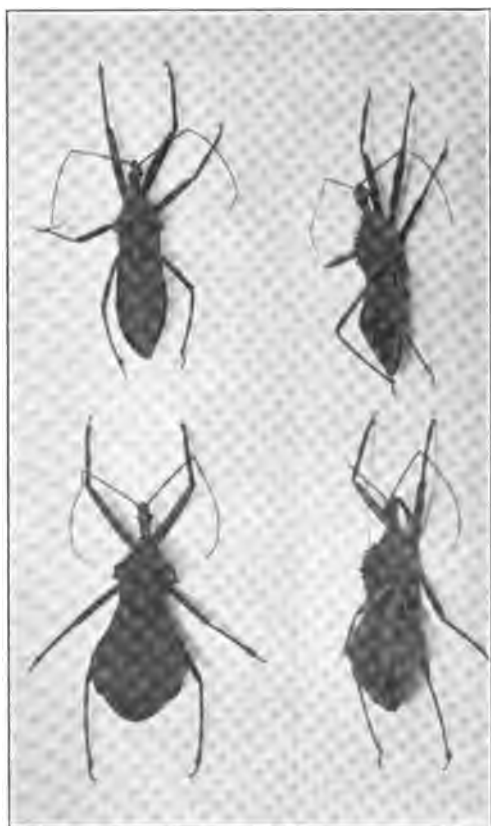


Fig. 14. Back and side views of the wheel bug, male (upper), and female (lower); natural size.

presence and occasional abundance in locust trees. It is a small, slender-bodied, bronzy beetle of the same family as the flat-headed apple tree borer, and like the latter works under the bark. Its injury as a bark beetle is not often apparent, but the adults are common on the leaves, and have a very singular way of chewing the edges of the leaflets so as to give them a rough appearance. The roughness is so slight, however, as easily to be overlooked. The mischief is not of great importance, except when taken with that of numerous other leaf-gnawing insects of locust trees. It could doubtless be controlled by the use of a spray of arsenate of lead.

INSECTS ATTACKING THE YOUNG TWIGS AND LEAVES.

The leaves of black locust harbor at all times a large number of insects representing a long list of species. They attack the leaves in various ways, some by gnawing, some by puncturing, some by mining them, etc.

Leaf Miner No. 1.—The Black and Yellow Locust Hispa (Chalepus dorsalis).—Among the leaf insects infesting the trees this is the worst. The adult is a small yellow and black, flattish beetle often found among the leaves, and sometimes in this condition doing a good deal of harm. Its eggs are laid in packets, each of about five flattened, somewhat triangular eggs. On hatching the young all bore into the leaf and make a mine between the two cuticles, upper and under, their food consisting of the green substance of the leaf. By gnawing this away the foliage is soon made to assume a brown hue, and as the little miners scatter and make new mines for themselves the whole foliage of a tree may be embrowned by the latter part of the summer, giving it the appearance of having been damaged by fire. The little grub in each mine ceases feeding after a while, becomes a quiescent pupa lying in the middle of the mine it has made, and finally emerges as a beetle to mate and lay eggs for a new brood. One brood becomes mature in July, and another, generally less numerous, matures in late summer and passes the winter among rubbish under the trees.

A second smaller brown beetle of the same genus (*Chalepus nervosa*) is common as an adult about locust

trees and feeds upon the leaves, but its early stages have not been secured by me from this tree.

In addition to these beetle leaf-miners the locust trees in Kentucky are infested by a small group of moths which in their larval stages mine, or skeletonize, the leaves. They were more common during the season of 1915 than the Locust Hispa. The following paragraphs are taken from an article of mine published a good many years ago, and not now accessible. They will give an idea of the nature of the injury and the character of the insects:

Leaf Miner No. 2 (Gracillaria lespedezifoliella).—Several other insects make blisters on the leaflets not very different in general from blisters made by the young Hispa. The casual observer is likely to mistake the latter for the ones already described. One of these is produced by the larva or grub of a moth, about the size of the common clothes moth so troublesome in dwellings. It is in fact a closely related insect. The blister when fully formed may be recognized by the fact that it lies along the midrib of the leaflet, and has processes or lobes extending out toward the margins. It is yellowish brown in color and is narrowly edged with reddish brown. To distinguish it from other blisters, I have named it in my notes the digitate blister. The grub is somewhat flattened like that of the Locust Hispa, but is more slender. The manner in which these blisters are formed is so curious that I must describe it for the benefit of those interested in insect architecture. About June 1, small whitish triangular blisters occur in the angles, formed by the junction of the veins and midrib on the under side of leaflets. No one would suppose they had anything to do with the digitate mines of the upper surface, which appear somewhat later. But they are the beginnings of digitate mines. The little moth places a single lens-like egg at the edge of a vein about one-eighth inch from where it joins the midrib. The grub, hatching from the egg, bores into the leaf at once, and then makes a narrow mine along the vein until the midrib is reached, when it mines along the latter in the same way and for about the same distance, the mine being now V-shaped. Then it turns back on its course and mines alongside the

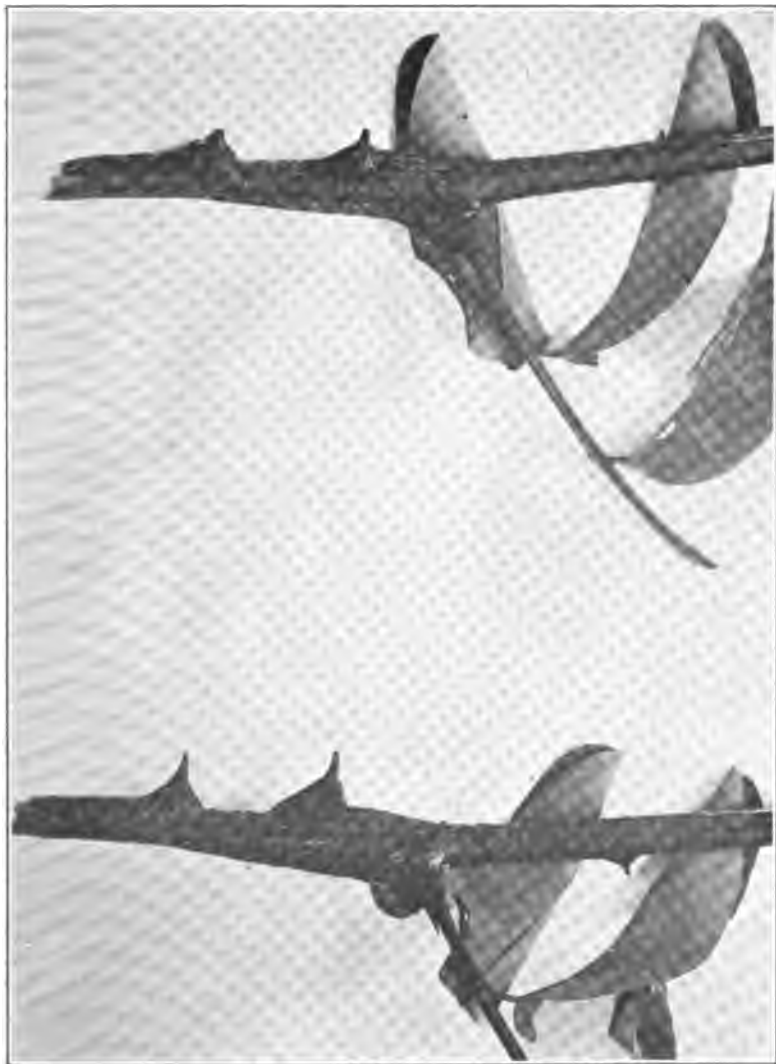


Fig. 15. Two views of a twig occupied by a twig miner, showing also the bug, *Thelia bimaculata*, and its striking resemblance to one of the thorns; natural size.

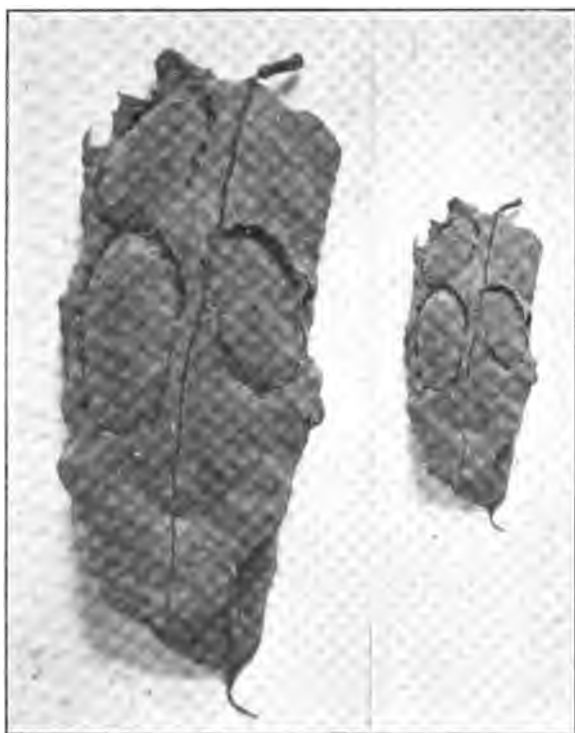


Fig. 16. The cases made by the locust twig miner by cutting out ovals from two leaves, when ready to pupate. The figure at the right, of natural size.

second arm of the V until the angle is reached again, when it goes out along the first-made arm, only to return when it reaches its extremity. And thus it continues until all the space included between the arms of the V is mined, and the little blister is triangular in shape. Instead of continuing on the under side of the leaf the grub now cuts through to the upper side of the midrib and makes a larger mine along it, at first linear in general shape, but gradually extended until finally it assumes the digitate character of the completed blister. While the grub is yet small it will, when its mine is laid open, retreat promptly into the triangular mine of the under side. At least two broods of this insect develop each season, the second lot of mines appearing in the latter part of August. The moths are so retiring in habit that they are not often seen. Just how it passes the winter I am unable to say positively, but it appears to leave the blister, and it is probable that it becomes a pupa among leaves on the ground beneath the trees. The adult moth is brown, the fore-wings marked with three oblique silvery lines shaded with dark brown, and with as many silvery dots on the inner margin.

Leaf Miner No. 3—Ostensacken's Leaf-miner (Lithocolletes ostensackenella).—A third very common blister on locust leaves is produced by the larva of another small moth, also much like the clothes moth in structure. It is one of the most beautiful midgets when it has acquired wings in the whole range of animated existence. The fore wings are of a rich brown color and shine as if made of burnished metal. Each wing is crossed by four silvery lines, edged in front with black, the two outermost broken at the middle. It is not more than an eighth of an inch long from the front of the head to the tips of the folded wings. This little moth places its flattened egg either on the upper or under surface of the leaflet, and is also indiscriminate as to the part of the leaf chosen. The recently hatched grub makes at first a tortuous mine, but soon abandons this style of construction and enlarges it into a more or less round blotch-mine of a yellowish brown color. The worms change to pupae in silken cases which they spin within the mines.

Leaf Miner No. 4—The Autumnal Locust Leaf-miner (Lithocolletes robiniella).—About the first of August a pure white blister, generally elongate-oval in outline and restricted to one side of the midrib, appears, most often on the underside of the leaflets. It can be distinguished from the yellow blotch-mine by the fact that it is not linear and tortuous at first. The egg is placed by the moth at the edge of the prospective blister, and the young grub produces a blotch-mine at once, only making it gradually larger with its own increase in size. By the third week in August some of these blisters contain quiescent pupae in little white cocoons, and by the last of August the adult moths come out. They are very similar to the moth of No. 3, but the silvery lines do not extend entirely across the fore wings, and there is a distinct black spot at the free ends of the wings. In addition there are some golden lines alternating with the silver. The wings are closely folded about the body when at rest. Over the head projects a dense tuft of bristly hairs, the central black, the others white. It measures about an eighth inch from the tip of the frontal bristles to the ends of the folded wings.

The Locust Leaf-skeletonizer (Gelechia pseudacaciella).—Though not a leaf-miner, this insect is closely related with the three preceding species. It draws the leaflets together and lives between them, gnawing away the surfaces. It is very active in its movements and scurries back into its retreat when uncovered, and often when pursued further lets itself drop from the foliage by means of a silken thread which it emits from its lower lip. The fully grown worm is three-fourths of an inch long, pale green in general color, with brown head and six pale longitudinal stripes. The very young larvae are darker in hue. These skeletonizers are found among the leaves from June to October. Pupae are found in July, and adults emerge from them in August, placing eggs for a late brood. The adult moth has a wing expanse of two-thirds of an inch. It is dusky in general color, marked with black and ash-gray.

The Locust Skipper (Eudamus tityrus).—This is a much larger insect than the preceding miners and skeletonizers and as an adult is very common about clover

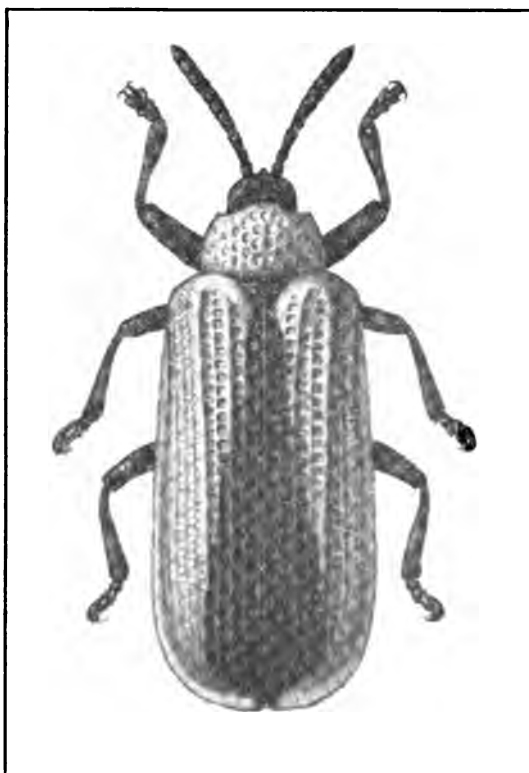


Fig. 17. The adult Locust Hispa (*Chalepus dorsalis*), greatly magnified (X 12).

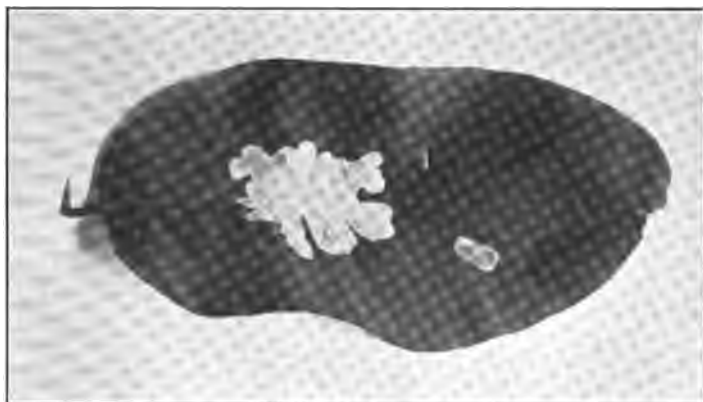


Fig. 18. The Digitate leaf mine; natural size.

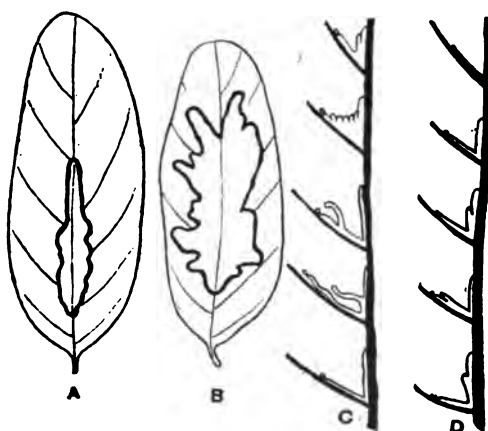


Fig. 19. A, the Digitate mine when first made on the upper side of a leaflet; B, the mine when completed; C and D, mines as first made in the angles of veins on the under sides of leaflets, in various stages, the two upper ones at the left being nearly complete.

blossoms and other flowers during the summer. It is a brown butterfly with a large silvery blotch on the under side of each hind wing. The young, which works in locust leaves, is a thick-bodied, yellowish green worm, with a singular, large, reddish brown head marked with two large, round, yellow spots resembling eyes. It draws the leaflets together and lives within and feeds upon them. The brown pupa is formed in these shelters and is the condition in which the insect spends the winter.

PUNCTURING INSECTS.

A good many insects puncture the leaves or young twigs and suck the sap. They are common enough at times to weaken the trees greatly, but ordinarily the mischief of a season is done by the gnawing insects. The following puncturing insects have been frequently observed on locust trees in Kentucky:

Lopidea robiniae.—A common insect at times.

Tree-hopper (Thelia bimaculata).—One of the commonest tree-hoppers on the locust, from the twigs of which it sucks the sap. It is not often observed because of its remarkable resemblance to some of the thorns on the twigs. I have been impressed with this resemblance more than once since my attention has been given to locust insects. If there is anything in the idea of "protective resemblance," this is certainly an instance of it. The photograph shows very well the nature of the resemblance.

Tree-hopper (Vanduzee arcuata).—This insect is another common locust tree-hopper. It is gregarious in habit, and numbers, young and adult, are often found together on the twigs, where they are attended by a large black ant, probably after the sap also.

Tree-hopper (Acutalis calva).—A small, shining, black species, frequent on the trees.

Two-spotted Tree-hopper (Euchenopa binotata).—Not as common on locust as the two preceding.

Buffalo Tree-hopper (Ceresa brevicornis).—Occasionally found on the trees.

Ormenis pruinosa.—Frequent.

Flata conica.—Occasional.

Nezara pennsylvanica.—This is one of the stink bugs, a broad, flat, green species, sometimes found about the trees.

Empoasca mali.—Frequent.

Empoasca splendida.—Common.

Typhlocyba querci-bifasciata.—Occasional.

Diedrocephala coccinea.—Not rare.

Acanthia multispinosa.—Frequent. Like the wheel bug, this smaller insect is predatory. It probably attacks some of the small, injurious locust insects, but has not been observed doing so on the trees. In confinement it catches and destroys large numbers of flies.

TREATMENT FOR GNAWING AND PUNCTURING INSECTS.

While the number of species gnawing, mining and puncturing the leaves is large it is not to be supposed that they render the growing of locust trees unpromising as a business proposition. They can be controlled in most cases by spraying and by care in gathering up and destroying rubbish about the trees when they become numerous and are likely to hibernate in large numbers about the plantings. A spray of three or four pounds of arsenate of lead paste in a barrel of water should destroy most of the gnawing species. The puncturing sorts are more difficult to deal with, but sprays of lime-sulphur in winter, and of coal-oil emulsion should suppress these also. In fact, after watching these insects for two seasons, I am of opinion that the locust borer presents a more serious problem than all of the others together.

THE GOLDENRODS.

The name "goldenrod" is applied to these plants because of the frequent arrangement of the small heads of yellow flowers in close, often cylindrical, spike-like thyrses, or terminal panicles. They constitute a conspicuous feature of our late summer native plant life.

Along roadsides, on railroad right-of-ways, at the edges of fields, in thickets, along streams, the bright yellow hues of the flowers always appeal to the eye of the artist and nature lover, present in us all in large or small measure, and add to the attractiveness of the coun-

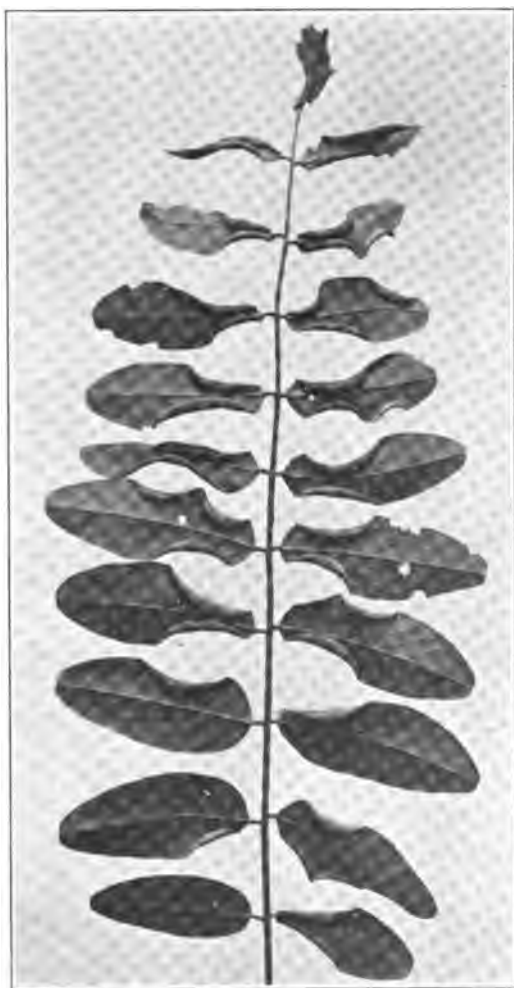


Fig. 20. Leaflets rolled by the locust midge (*Cecidomyia robiniae*), a very common injury in Kentucky. Reduced.

try at a time when cultivated crops are likely to be in a sere and unpleasing state. We shall lose something of the pleasure of living when these sprightly autumn flowers have all been banished from our fields. That they appeal to most of us is shown by the frequency with which they have been chosen as State Flowers. Even in Kentucky the goldenrod has had many votes as a flower representative of the Commonwealth.

But the term "goldenrod" has a very vague meaning when we consider the large number of species of plants properly so called. In the United States there are no less than 74 species, with numerous named varieties.

Seventeen species of the genus *Solidago* occur in Kentucky and perhaps a few more. An additional species (*Brachychaeta sphacelata*), sometimes in botanies called the false goldenrod, is regarded as a goldenrod, without question, by those not familiar with the obscure characters which have led botanists to place it in a separate genus; so for all practical purposes we may say that there are eighteen known Kentucky goldenrods.

They differ widely in character, with species, and to some extent with the situation and soil in which they grow. For while the different species show marked tendencies to thrive and become numerous in particular situations, chance often plays a part in their distribution and influences their character.

Thus such species as *Solidago altissima* are at their best on low, moist, rich ground, where they are often five or six feet in height; on higher, drier ground they are not so tall, though still showing a tendency to rankness of growth. They are pretty generally plants of the open fields, and are not at all disposed to invade woodland. *Solidago latifolia* and *S. ulmifolia* are examples of slight, low-growing plants, being commonly only eighteen inches or thereabouts in height, and are found along rocky wooded banks or bluffs.

The species are in some cases so closely related that even botanists find difficulty in separating them. The difficulty is enhanced by the disposition of some of them to hybridize, and the amateur flower lover is to be excused when he is unable to place to his satisfaction all the plants of the genus he finds.

The characters most depended on are the shape and size of the flower clusters, the shape of the leaves, and the presence or absence of down on stems, leaves and developing seeds (achenes).

As examples of two extremes *S. latifolia* and *S. altissima* may be selected. The former bears the flowers in small isolated clusters along the stem in the axils of the upper leaves, sometimes with a continuous cylindrical assemblage several inches in length at the tip. There are no *very* long lateral flower-bearing branches. The leaves, too, are broad, oval, the width sometimes two-thirds to three-fourths the length. *S. altissima*, on the other hand, is a tall, stout-stemmed plant, with narrow, tapering leaves, the flowers restricted largely to a large, wide-spreading terminal panicle, the lower branches of which may be six inches or more in length.

Some of the native species are now listed by dealers in florists' stock, but are not as much grown at the present time as they deserve to be, merely for their beauty. Some of them deserve attention, also, because of reputed medicinal value. The European *Solidago virgaurea* was at one time employed in medicine. *Solidago odora* of this country is also said to have some value of this sort. The word *Solidago* means to make whole, and has reference to the use of infusions of the plant to cure wounds.

A yellow dye has been obtained from some of the species. The name Dyer's Weed, applied to *S. nemoralis*, seems to have reference to this use of the plant.

The following species occur in Kentucky:

Wreath Goldenrod (*Solidago caesia*). In woods. High Bridge, Oct. 15, 1892. Natural Bridge, Oct. 21, 1911. Earlington, Oct. 3, 1914. Central City, Oct. 5, 1914.

Broad-leaved Goldenrod (*Solidago latifolia*). Shaded banks and bluffs in rich soil. Elk Lick Falls, Aug. 17, 1892. High Bridge, Oct. 15, 1892. Frankfort, Sept. 30, 1914. Clifton, Oct. 4, 1914.

Curtis' Goldenrod (*Solidago curtisii*). Kentucky (Gray's Manual). Said to occur in mountain woods.

Pale Goldenrod (*Solidago bicolor*.) Kentucky (Gray's Manual). Dry soil.

Puberulent Goldenrod (*Solidago puberula*). Sol-dier, Ky., Sept. 9, 1893.



Fig. 21. Several panicles of the Tall Goldenrod (*Solidago altissima*) flowers; greatly reduced.



Fig. 22. A single panicle of the Tall Goldenrod, showing the characteristic curve and droop of the branchlets; natural size.

Early Goldenrod (*Solidago juncea*). McHenry, July 30, 1892. Leitchfield, Aug. 7, 1904. Dry soil.

Anise-scented Goldenrod (*Solidago odora*). Natural Bridge, Oct. 21, 1911. Dickey's Mills, July 14, 1896.

Elm-leaved Goldenrod (*Solidago ulmifolia*). Elk Lick Falls, Aug. 17, 1892. Benson Creek, Frankfort, Sept. 30, 1914. Edges of woods.

Rough-leaved Solidago (*Solidago rugosa*). Natural Bridge, Aug. 29, 1915.

Short's Goldenrod (*Solidago shortii*). Clay's Ferry, Aug. 22, 1892. Among rocks along streams.

Dyer's Weed (*Solidago nemoralis*). Hopkinsville, Aug. 8, 1892. Richland, Aug. 19, 1904. Dry soil in the open.

Canadian Goldenrod (*Solidago canadensis*). Lexington, Aug. 29, 1892. Nortonville, Aug. 7, 1892. Tarascon, Aug., 1910. Rich soil in tangles of herbage, etc.

Rock Goldenrod (*Solidago rupestris*). Clifton Banks of Kentucky River, Oct. 4, 1914.

Tall Goldenrod (*Solidago altissima*). Lexington, Sept. 12, 17, and Oct. 8-12, 1914. Clifton, Oct. 4, 1914. Earlington, Oct., 1914. Aden Springs, Oct. 2, 1892. Common in rich soil in open situations.

Late Goldenrod (*Solidago serotina*). Tyrone, Aug. 25, 1892.

Ohio Goldenrod (*Solidago ohioensis*). McHenry, July 30, 1892. Wet land.

Flat-topped Goldenrod (*Solidago graminifolia*). Nortonville, Aug. 7, 1892. Waco, Aug. 20, 1902. Moist situations.

False Goldenrod (*Brachychaeta sphacelata*). Elk Lick Falls, Aug. 17, 1892. Clifton, Oct. 4, 1914. Wooded banks of streams.

SUMMARY AND SUGGESTIONS.

1. The locust borer is a black and yellow beetle when adult, occurring from the latter part of August until late October on the flowers of goldenrod, particularly on those of the common, rank-growing species known as *Solidago altissima*.

2. The injury is done to locust trees by the grubs or immature beetles which mine the trunks and branches,

being most active from May until mid-August, when they become quiescent pupae within the burrows.

3. The food of the borer is the wood of the locust trees; that of the adult, the pollen of goldenrod.

4. Since the adult insects seem dependent on pollen and are abundant only where it may be secured it is suggested as a means of lessening the injuries, that all goldenrod in the vicinity of plantings be destroyed, or be sprayed with arsenate of lead in early September so as to destroy the beetles. A spray consisting of three or four pounds of the poison in a barrel of water should be used.

5. Spraying the trunks of trees with the same poison is suggested as a further precaution, and should be applied about the first of September when the beetles begin to emerge from the trees.

6. Old, badly infested locust trees in the vicinity of plantings serve as a breeding place for the borers and if of no value should be destroyed.

7. Baits other than goldenrod have thus far not proved very successful. A few beetles were captured in fly traps hung in young trees near the Station Building, and baited with banana, but the number was not large. More of the beetles were attracted to *Solidago* of several species, near by.

8. The gathering of the beetles from goldenrod by children, as suggested years ago by Harris, is not, it seems to me, impracticable for all plantings and would no doubt reduce the injuries.

9. The locust borer is not evenly distributed over the State. It is most numerous and injurious on open tracts of good soil where the Tall Goldenrod, *Solidago altissima*, is most abundant. It becomes less common in those parts of the State where this plant and the closely related *Solidago canadensis* are least common. It feeds upon other goldenrods when the above species are not present, but these two bloom at the time when the adult borers come from the trees and appear to be their main dependence for food.

In the mountain counties, accordingly, the injury to locusts is less severe than elsewhere, and this region affords thousands of acres of cheap land upon which the

trees may at present be grown with the assurance that the injury will be less severe than elsewhere in the State. By keeping goldenrod of all sorts suppressed in the vicinity of plantings that may be established there the chances seem to me good to keep the injury from becoming severe in the future.

NOTE.—The writer is indebted to several members of the Staff of the Department for assistance of one sort or another in making this study. Assistant Professor Vaughn has made many of the photographs. Messrs. Jewett and Niswonger examined the commercial plantings of locust and from time to time have collected material for examination. A student, Mr. Leon Leonian, has aided by cutting out larvae and pupae, and on one occasion collected from the foliage of trees in this neighborhood the miscellaneous insects commonly found there.

THE PRACTICE OF PRIVATE FORESTRY IN EASTERN KENTUCKY.

BY

M. H. Foerster, Forester for the Consolidation Coal Co.

Private forestry is still in the experimental stage, in the country at large, as well as in Kentucky. Its practicability has not yet been proven, though many of the aims and principles of the profession have been adopted and are being practiced by private individuals, who can see somewhat farther ahead than the average man.

In the eastern part of the State, where the bulk of its forest and timber resources are to be found, the practice of forestry will find its greatest field, from a protection and conservation viewpoint, as well as of growth for future use. The rugged mountains of Eastern Kentucky represent vast wealth in the coal underneath the surface and their timber above. The best of the timber has been exploited, the next best is being rapidly cut and removed, and if continued at the present rate, but little will remain for the use of the coal industry, to which it is an indispensable necessity.

The Lord never intended to have the Eastern mountains farmed, or he would not have made them so steep and the valleys so narrow. As long as coal and timber industries thrive there, the country will prosper—as soon as these resources have become exhausted, Eastern Kentucky will cease to exist, excepting for hermits. Unless the timber covering is maintained, the coal business will be seriously hampered, with a resultant effect upon economic conditions throughout the State. That the timber and wood-working industries of the State will be the first to suffer need not be mentioned, that is self-evident. The relation of timber to coal and of coal to the practice of forestry is, moreover, the object of this

discussion. When the Consolidation Coal Company in 1911 undertook the task of pioneer in the development of the Eastern Kentucky coal fields, it saw farther ahead than many others, saw the possibilities in the coal development, and took the necessary precautions to safeguard all factors, tending to create permanent favorable conditions for such development. One of these was the guarantee of its timber supply, both present and future, and accordingly it became the pioneer in the practice of forestry in this part of the State.

To give an idea of the scale of the work, this company has opened fourteen mines, and has about 18,000 acres of timberland available for mine use, besides 6,000 acres in more or less inaccessible localities. Thirty-three million feet of lumber and timbers were cut from the closest 6,000 acres during the first two years of development. Seventy-eight per cent of this was used on the ground in outside construction work, 9 per cent was shipped to market, while 13 per cent remained on the ground for mine use, and later construction purposes.

During 1914 all mines consumed 2,600,000 feet board measure of lumber, rough and dressed, ties, props, caps and cross timbers included, at a total value of close to \$33,000.00. It must be remembered that this was an off-year, abnormal to the extent of having all but five mines shut down approximately five months, and these five not running on full time steadily. The year 1915 will show an increase in consumption of at least 40 per cent, and this increase will continue from year to year, the older the mines grow, in exact proportion to their output in tonnage.

The first two lines of attack in the practice of forestry, no matter where, are 1 "Protection," and 2 "Utilization."

Protection includes both the agencies of fire, which is the most conspicuous and destructive, and grazing, which is less conspicuous, but as detrimental as fire in the long run. Whoever has traveled through the forests of Eastern Kentucky, and has previously seen hardwood forests in other sections of the country, cannot help but notice the apparent lack of young timber of the pole and sapling stage, excepting a scattering of various sizes and

species in many aged stands. This all has its origin and cause. The character of past cuttings is one factor. Only a few of the finest trees were taken out first, then a few of another variety, and so on, with sufficient time between cuttings for the crowns to close and shade the ground to the exclusion of all but the most tolerant seedlings. Hogs and sheep have run at large, gnawing back the few sprouts and seedlings which succeeded in getting a start, and devouring all the sound acorns and chestnuts which reached the ground. A peculiar thing about these hogs is that they never make a mistake in picking out the fertile nuts and acorns. To facilitate their search, the inhabitants of the mountains formerly fired the woods purposely. Even to this day a mountaineer will pay no attention to a forest fire unless it is within striking distance of his rail fence, then he will fight like a fiend. Fires and stock have had an unobstructed right to travel where they pleased, and this has had the result of keeping out the much desired and much needed full stand of second growth timber.

The ideal type of forest for mining purposes is a full, even-aged stand of young pole timber of suitable varieties, which will reproduce itself naturally, after the end of each rotation.

Forestry does not merely consist in planting trees and preventing forest fires. Forestry ultimately overcomes the handicap of planting, by creating stands which will reproduce naturally, if properly managed, and thereby save the expense of artificial regeneration. The foundation of forestry and its ultimate aim is the growth of timber of the proper varieties, to the most economic size in the shortest possible time.

Many coal operators make the mistake of using only what timber they now have on the ground. In other words, they cut some of the stand now, some two years later, and the rest a few years after that. The work is done by contract, unscrupulously as a rule, with regard to the young timber coming in. Each time the stand is disturbed, the young timber is bruised, torn up and set back many years. By the time the last trees of the original stand are removed, which are always those inferior, defective trees which should have been the first to go,

what have they to show for the basis of a new crop? A mixture of bruised and deformed trees of many varieties, with the undesirable, unadapted species leading in the percentage of mixture.

But very few operators even to this day pay any attention to fires or grazing. During the summer of 1915 this company took the lead in the formation of an association for the protection of timberlands among the large owners in the counties of Knott, Pike, Letcher and Floyd, Kentucky, and Dickenson and Wise, Virginia. Though the majority expressed their willingness to join, their failure to recognize the importance of the undertaking and give up some of their time to the organization of the association, resulted in a suspension of the work along that line. The Consolidation Coal Company has an adequate system of protection of its own, but is co-operating with the State Department in the protection of lands outside of its own boundaries in the eastern section of Letcher County.

The stock protection feature has not been entirely worked out, nor will it be until the State takes a hand to control it. At present stock ordinances within the limits of the two incorporated towns of the company have secured protection on about 5,000 acres, the results of which are already evident after eight months of enforcement. The outlying tracts, 20,000 acres in extent, are still unprotected, but it is planned to cover these with a new form of lease to tenants requiring the fencing of pastures for the grazing of stock which they own, and the supervision of trespassers from the outside.

The only other feasible plan of securing a stock law county-wide, and it will always be a "county" question, will be a majority of magisterial districts. This is slowly progressing, is being bitterly fought, and is sorely mixed with politics—hence no help can be expected from this source for the next five years or more.

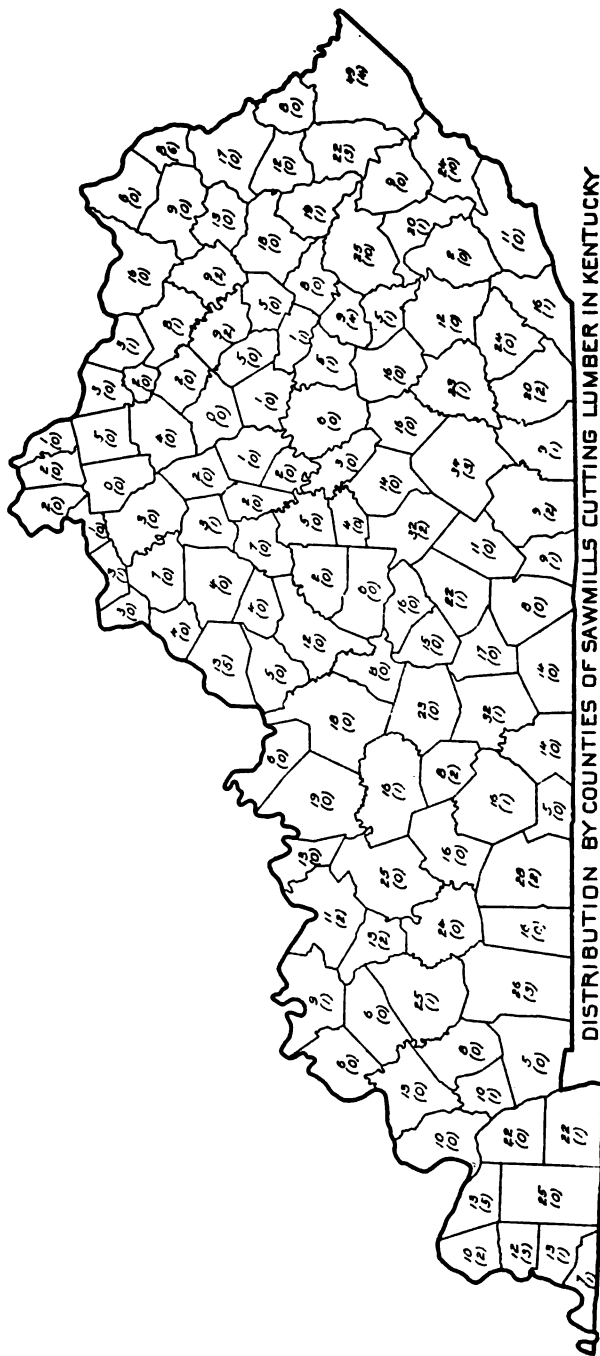
As long as stock and fires run unhindered, so long will the practice of forestry be unable to prove its value and practicability. In order to create a permanent supply of timber for our mining industry, we must grow timber on every foot of ground available, plant up the waste and cleared ground, now unused and producing

nothing, and apply scientific principles to secure even aged stands out of our present natural forests, to increase the yield per acre, and to secure a fully stocked natural stand of young growth. We can grow timber for mine use in 20 or 25 years, depending on the variety of tree we select, and those who neglect to prepare for the future now will have to pay the price within the next fifteen years. Judicious, wise use of all we have now, without waste, with the aid of preservative treatment wherever it can be advantageously used, can't be too strongly impressed upon the owners of timberlands and operators of coal mines in this field today.

I CUMBERLAND MOUNTAIN REGION
 II BLUE GRASS REGION
 III CENTRAL HIGHLAND REGION
 IV WESTERN COAL FIELD REGION
 V WESTERN LOWLAND REGION

FARM WOODLOT REGIONS IN KENTUCKY AND PERCENT OF ACREAGE

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DISTRIBUTION BY COUNTIES OF SAWMILLS CUTTING LUMBER IN KENTUCKY
IN 1912 SHOWING TOTAL NUMBER OF MILLS AND (IN PARENTHESIS) NUMBER
OF MILLS CUTTING OVER 1,000,000 BOARD FEET

**MARKETING OF WOODLOT PRODUCTS IN
KENTUCKY.**

By

W. D. STERRETT,

Forest Examiner, Forest Service U. S. Dept. of Agri.

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THE WOODLOT SITUATION IN KENTUCKY.

In 1880 nearly one-half (47 per cent) of the farm area of Kentucky was in woodland; in 1910, less than one-third (31.3 per cent). The decrease still proceeds and doubtless will continue for years to come. This is to be regarded as a benefit to the State and a sign of increasing prosperity to the extent that it opens up good tillable land for the reception of agricultural crops. The process of clearing, however, has been an expensive one to the farmers. Many sold their material cheaply in the immediate vicinity, not realizing that much better prices could be obtained by grading and shipping their products to not too distant points where industries with special demands existed. There was ignorance, also, of the kinds, sizes, qualities, and values of the wood required for these different uses. It is the purpose of this bulletin to supply such information or the sources from which it may be obtained, and thus make easier the profitable sale of woodlot timber. It is not its purpose, however, to recommend the indiscriminate sale of all woodlot material, even when of the finest quality.

The reasons why all but the smallest farms should have woodlots are too obvious and have been demonstrated too often to require special consideration in this bulletin.* Many farmers in Kentucky, as elsewhere, are today regretting the haste with which they got rid of stands of timber for much less than their value, in order to make room for agricultural crops. The great reduction in the woodlot area which is still going on for this purpose in most of the counties is not always justifiable. Thrifty young timber should in many cases be allowed to mature or should be left standing until market conditions are more favorable. Furthermore, when clearing is done it should be so conducted as to leave untouched that part of the woodland which is most suit-

*See U. S. Department of Agriculture Bulletin. "The Status and Value of the Farm Woodlot" (in press).

able for a permanent woodlot. As a rule this is the part of the farm least suitable for agriculture, except in those cases where the woodlot may serve also as a windbreak for buildings or crops, a shelter for stock, or a protection against erosion.

WOODLOT REGIONS.

In the five natural divisions of Kentucky (see map)—the Cumberland Mountains, the Blue Grass Region, the Central Highlands, the Western Coal Fields, and the Western Lowlands—there are considerable differences in the character and economic usefulness of the woodlots. The sizes, kinds, and qualities of the trees are different, as are also the markets which are available for the sale of woodlot products.

The Cumberland Mountains have about 55 per cent of their farm area in forest. While in the past the poor transportation facilities, the scarcity of large towns, and the small variety of wood-using industries have largely restricted the removal of timber for sale to the best classes of woodlot products, the poorer classes are now becoming marketable at good profits to the farmer. It is likely that the timber industry will always be important to farmers in this region, and the present woodlot area ought not to diminish greatly. Woodlots will always be especially useful here to utilize the steep soil and keep it from eroding.

The Blue Grass Region, having less than 10 per cent of its farm area in woodland, excellent transportation facilities, numerous towns and cities, and good markets for forest products, presents a striking contrast to the Cumberland Mountain Region. In some counties less than 3 per cent of the farm area is forested and there are a large number of farms with no woodlots. A large part of the remaining woodlots are open, pastured groves of declining veteran trees. This region is very much in need of a vigorous and concerted forest policy by the farmers to maintain permanent woodlots, if for no other reason than to protect crops from wind. In some places, especially in the outer section, woodlots can be confined to very steep or rough land which is really better suited to permanent forest crops than to agriculture because

of the difficulty of cultivation or danger from erosion when cleared.

In the Central Highlands about one-third of the total farm area is at present in woodland. In the northern part, near the Ohio River, however, the farm lands are less than one-fifth wooded, while in the southern part woodlots make up over half the farm area. Transportation facilities and markets for woodlot products are fairly good, except in several counties in the southeastern part which have no railroads entering them. In some cases, however, lack of railroads is largely offset by the Cumberland and Green rivers as means of transporting forest products. The wood-using industry in the region is fairly diversified, calling for all kinds and classes of forest products. There is more land in woodlots than will be permanently so held, but small permanent woodlots will always be needed, not only for supplying forest products but for protective and other purposes. The soil is for the most part good agricultural soil suitable for stock farming and tobacco growing.

In the Western Coal Field region the aggregate woodlot area varies, by counties, from about 10 to about 30 per cent and averages about 20 per cent of the total farm area. Transportation facilities and market conditions for woodlot products are usually good. There is a variety of wood-using plants in the region or near it, furnishing good markets for all kinds of forest products. The land in this region usually lies well, has good soil, and most of it is suitable for agricultural crops. The woodlot area can be reduced considerably in many counties without harm, but in a few the process has already gone too far and an increased amount of woodland is needed.

The Western Lowlands region has from 20 to 30 per cent, and an average of about 25 per cent of its farm area in woodland. The whole region is good agricultural land, but much of it needs drainage. The area of permanent woodlot will be small, but should always be provided for by the farmer in clearing up his woodland. Transportation facilities are excellent and there are fair markets for woodlot products within the region or adjoining it.

USES OF THE NATIVE WOODLOT TREES.

The commercial importance in the lumber industry of Kentucky of the various native woodlot trees is shown for each of the natural regions of the State in Table 1.

The most generally important kinds are oaks of various species, yellow poplar, hickories, beech, chestnut, and red or "sweet" gum. Walnut, cherry, and ash, while very valuable where they are found, are no longer abundant in woodlots. The pines, basswood, elm, maple, sycamore, buck-eye, and black gum are also of secondary importance in the lumber cut of the State. Of the other species shown in the table, hemlock, white pine, spruce, cypress, and tupelo gum are cut in considerable quantities in Kentucky, but are rarely found in farm woodlots and for this reason are not considered in this report.

THE WOOD-USING INDUSTRIES.

The wood-using industries of Kentucky may be counted upon as markets for all but the lowest grades of woodlot products. They may be divided into two groups; those which use logs, bolts, and billets, and those which use lumber. The first of these groups is of chief importance, because the farmer is seldom in a position to turn cut sawed lumber.

INDUSTRIES WHICH USE LOGS, BOLTS, AND BILLETS.

The industries which use logs, bolts, and billets, and the approximate amount of raw material consumed by each are shown in Table 2. The remarks which are included in the table as to the kinds of material used and the proportion cut from farmers woodlots are intended to give an idea of the possibilities of a particular industry as a market for woodlot products. A directory of users of logs, bolts, and billets classified by industries, is given on pages 129 to 130.

Table 1. Commercial trees in the different woodlot regions in Kentucky, arranged in order of their relative importance as indicated by the proportion which each formed of the total lumber cut of all in the region in 1912.

Entire State 641,296 M. B. F.		I Cumberland Mountain Region 306,877 M. B. F.	
Species	Total Lumber Cut	Species	Per cent of Total Lumber Cut
Oak	321,656	Oak	51.8
Poplar	91,225	Poplar	20.7
Beech	39,051	Yellow Pine	6.5
Hickory	30,748	Chestnut	5.0
Red Gum	28,136	Hemlock	4.2
Chestnut	26,624	Beech	3.4
Yellow Pine	25,755	Hickory	2.5
Hemlock	14,040	Basswood	2.1
Ash	9,588	Ash .....	.8
Maple	8,217	Maple .....	.8
Basswood	6,986	Walnut .....	.4
Walnut	5,855	White Pine .....	.4
Sycamore	4,837	Buckeye .....	.3
Elm	3,797	Spruce .....	.3
Cedar	2,830	Sycamore .....	.2
Cypress	2,535	Red Gum .....	.2
Cottonwood	2,498	Cedar, Birch, Elm and Bal- sam Fir	0.1% each
Buckeye	1,675	Others, Cherry, etc.	
White Pine	1,506		
Spruce	1,076		
Birch	896		
Cherry	329		
II Blue Grass Region 39,332 M. B. F.*		III Central Highlands Region 144,600 M. B. F.	
Species	Per cent of Total Lumber Cut	Species	Per cent of Total Lumber Cut
Oak	55.0	Oak	51.4
Beech	10.0	Yellow Poplar	11.7
Yellow Poplar	9.4	Cedar	9.1
Hickory	6.0	Hickory	7.6
Yellow Pine	4.0	Beech	6.4
Chestnut	2.5	Chestnut	5.2
Ash	2.2	Red Gum	2.0
Hemlock	2.2	Ash	1.3
Sycamore	1.9	Sycamore	1.1
Maple	1.9	Maple	1.1
Walnut	1.2	Walnut .....	.9
Elm .....	.9	Yellow Pine .....	.5
Cedar .....	.6	Buckeye .....	.4
Red Gum .....	.6	Elm .....	.4
Basswood .....	.5	Cottonwood .....	.2
Buckeye .....	.3	Basswood, Cherry, Birch, Hemlock, and White Pine	0.1% each
Cherr .....	.2	Others, Tupelo, etc.	
White .....	.2		
Spruce, h and Cotton- wood	0.1% each		
Others, Tupelo, etc.			

*Largely from logs shipped in from outside region or State.

IV Western Coal Fields 54,233 M. B. F.		V Western Lowland Region 73,106 M. B. F.*	
Species	Per cent of Total Lumber Cut	Species	Per cent of Total Lumber Cut
Oak	45.6	Oak	50.5
Red Gum	15.3	Red Gum	21.6
Beech	14.0	Hickory	7.3
Hickory	7.8	Yellow Poplar	5.6
Yellow Poplar	5.1	Cypress	3.2
Maple	3.2	Cottonwood	2.5
Elm	2.3	Beech	2.0
Sycamore	1.9	Elm	1.9
Ash	1.6	Ash	1.6
Walnut .....	.9	Sycamore	1.6
Cottonwood .....	.8	Maple	1.1
Yellow Pine .....	.4	Yellow Pine .....	.3
Chestnut .....	.4	Birch .....	.3
Cypress .....	.4	Chestnut .....	.2
Birch .....	.2	Walnut, Cherry and Tupelo	0.1% each
Hackberry .....	.1	Others, Buckeye, Basswood and Cedar.	
Others, Tupelo, Basswood and Cherry.			

*Largely from logs shipped in from outside region or State.

TABLE 2—Wood-using Industries of Kentucky (Classified According to Their Products) Using Logs, Bolts and Billets, and the Approximate Amount of Raw Material Consumed in Each.

Product	Number of Board Feet or its Equivalent used	Remarks
1. Firewood 3,678,800 ^a cords	.....	95 per cent. cut and used on farms.
2. Sawmills cutting rough lumber	641,298,000 ^b	All species used. About half cut from farmers' woodlots.
3. Tiles	300,000,000 ^c	Two-thirds white oak, including chestnut oak and post oak; one quarter red and black oaks; remainder soft woods.
4. Fence posts, rails, and hewed pieces used on farm	100,000,000 ^d	Chiefly cedar, locust, chestnut and oak. Most of the material from farmers' woodlots.
5. Tight cooperage	75,000,000 ^e	White oak, from choice logs and bolts. Over half from farmers' woodlots.
6. Mine timbers (not including 8,000,000 feet of sawed lumber used in mines)	25,000,000 ^f	Chiefly oak. Very little from farmers' woodlots.
7. Vehicle stock	30,000,000 ^g	Chiefly hickory, white and red oak. All choice logs down to 10 inches in diameter.
8. Veneer	30,000,000 ^h	All species. Choice and common logs, variable requirements.
9. Slack cooperage	25,000,000 ⁱ	All species. About half from farmers' woodlots. Medium to small trees.
10. Handles	14,000,000 ^j	Chiefly hickory, some white oak and ash. Chiefly from farmers' woodlots.
11. Poles and piles	10,000,000 ^k	Cedar and chestnut, for poles; miscellaneous species for piling; largely from farmers' woodlots.
12. Chestnut extract wood, 10,000 cords ^l	.....
13: Oak bark, 10,000 cords ^m	.....

^a1911 census.^bAccording to estimate in Circular 131 of the Forest Service, 1903.^cEstimate based on various investigations by the Forest Service and on census returns.^dEstimate by the author.^e1912 census.^fAccording to estimate in Circular 131 of the Forest Service, 1903.^gEstimate based on various investigations by the Forest Service and on census returns.^hEstimate by the author.ⁱ1911 census.^jAccording to estimate in Circular 131 of the Forest Service, 1903.^kEstimate based on various investigations by the Forest Service and on census returns.^lEstimate by the author.^m1912 census.ⁿAccording to estimate in Circular 131 of the Forest Service, 1903.^oEstimate based on various investigations by the Forest Service and on census returns.^pEstimate by the author.

About 90 per cent of all the wood taken from woodlots, except that which goes into firewood, is used for saw and veneer logs, railroad ties, and material for use on the farm. Firewood has little or no stumpage value, though it forms over half the total value of woodlot products. Where coal is cheap, more cut wood suitable for burning is left in the woods than is used, and the farmer's problem is to decrease the proportion which is left to rot. Trees of good size and quality are usually cut into sawlogs; small and medium sized trees and the rough tops of larger ones yield ties, two-thirds of which are hewed. White oak, chestnut oak, and post oak ties may be sold for nearly twice as much as red oak, black oak, and chestnut ties, and more than twice as much as softwood ties. Since the cost of hauling to the railroad or river cuts down the profit more than anything else, a one trip a day haul can be made profitably only with ties of the first three species mentioned.

Good markets for certain classes of woodlot materials are furnished by the tight cooperage, vehicle and handle industries. Supplying the bolts and rived stock for these markets often gives opportunity for the employment of farm labor during lax periods. The tight cooperage stock industry is confined chiefly to rough and inaccessible parts of the Cumberland and Central Highland regions; the vehicle stock and handle industries are State wide. White oak alone is used for standard heading stock for spirituous liquors. This brings a much higher price than does oil barrel stock, which is made also from chestnut oak and red oak. Large trees are required for tight cooperage; and since only a small part of the tree can be used, there is much waste unless the remainder of the tree is used for some other purpose. Vehicle and handle stock comes chiefly from small and medium sized hickory, white oak, red oak, and ash trees of good quality.

Mining timbers are an important woodlot product in a number of counties in the Cumberland and Western Coal Field regions. Although there are commercial mines in some twenty-five counties, the bulk of the industry is concentrated in about six of these: Muhlenberg

and Hopkins in the Western Coal Field, and Bell, Whitley, Knox, and Pike in the Cumberland region.

The tanning industry furnishes a fair market for chestnut oak bark and hemlock bark in those portions of the Cumberland and Central Highland regions in which these species occur in any quantity. At present, however, it pays in most cases to take the bark only from comparatively large trees, 15 or 20 inches in diameter. There is a market for chestnut wood for tannic extract plants in portions of the State, but very little profit is possible.

The market for chestnut and cedar poles is good throughout the State. That for cypress, oak, and gum piling is good anywhere in the western part of the State near the railroad, and occasionally a local market can be found.

INDUSTRIES WHICH USE LUMBER.

Over one-third of the total lumber cut in Kentucky goes to various wood-using industries in the State. A directory of the largest consumers of lumber in these industries will be found on pages 138 to 140. If a woodlot owner has lumber to sell, it will sometimes be more profitable to sell it direct to these wood-using industries than to the local lumber trade or general dealers and shippers. The following are the industries using sawed lumber, designated according to their products and arranged in order of the amount consumed. The principal kinds of native wood used by each are also listed.

1. Boxes and crating: chiefly gum, poplar, cottonwood, and sycamore.
2. Sash, doors, and planing mill products: oak, poplar, pine, beech, hemlock, and basswood.
3. Pulleys and conveyors: red gum, white oak, and sugar maple.
4. Vehicles: oak, hickory, poplar, and ash.
5. Cars and locomotives: oak, yellow pine, and poplar.
6. Furniture: oak, poplar, and gum.
7. Musical instruments: oak, poplar, pine, walnut, beech, and gum.

8. Store and office fixtures and mantels: oak, gum, poplar, ash, and birch.

9. Farm implements: oak, poplar, pine, ash, and hickory.

10. Chairs: oak, beech, maple, poplar, gum, sycamore, and ash.

11. Tables: oak, gum, ash, maple, and beech.

12. Kitchen safes, cabinets, and cupboards: oak, gum, ash, maple, beech, and poplar.

13. Coffins and caskets, and casket cases: chestnut, cottonwood, poplar, and walnut.

14. Trunks: pine, buckeye, basswood, gum, poplar, and elm.

HOW THE DIFFERENT SPECIES ARE USED.

The Oaks—

The oaks are by far the most important of the native woodlot trees, since they are found in all kinds of woodlots throughout the State. From the standpoint of utilization two general kinds are recognized: (1) white oak (including white oak, post oak, chestnut or rock oak, bur oak, cow or basket oak, and swamp white oak); and (2) red oak (including red oak, black or yellow oak, scarlet or spotted oak, pin oak, Spanish or southern red oak, water oak, shingle oak, willow oak, and black jack oak). Of all these species white and red oak are by far the most common and important. White oak is far more valuable than red because it is stronger, tougher, more durable, and therefore adapted to a greater number of uses. White oak trunks are usually more clear of branches and less apt to be defective than those of red oak. For certain uses not requiring durability red oak often brings the same price as white. White oak is more valuable in small sizes for ties, spokes, tight staves, vehicle dimension stock, and handles; and smaller trees of white than of red oak can thus be utilized. Red oak is often discriminated against in the market on the ground that it is not so strong as white oak, which is not uniformly true.

White Oak—

The important uses for the farmer to consider in marketing white oaks are: saw and veneer logs, ties, vehicle stock, and logs and bolts for tight and slack cooperage and handles. For clear or practically clear logs 18 inches and over in diameter at the top end, the most profitable markets are sawmills and veneer mills. Such logs always bring good prices at large plants which specialize in them. Clear logs less than 18 inches top diameter are most profitably sold to local mills manufacturing vehicle stock, tight cooperage, or handles; or they may be cut up on the farm into rough billets, according to specifications furnished by the prospective buyers, and shipped to finishing mills. Large logs of lower grade will pay best if sold to sawmills, provided two hauls a day per team can be made to the mill, shipping point, or river; otherwise they should either be sold to small local mills or cut into ties. Small "common" and large "cull" or low grade logs may best be disposed of to local mills, hewed into ties, or cut into bolts and sold to slack cooperage plants. The following summary shows what different classes of white oak material should be worth when delivered on cars, at the river, or at local mills:

Large select saw and veneer logs—

28 inches and up in diameter at top end.....	\$30 to \$50 per 1,000 bd. ft.
24 to 28 inches	25 to 35 per 1,000 bd. ft.
18 to 24 inches	20 to 25 per 1,000 bd. ft.
14 to 17 inches	15 to 20 per 1,000 bd. ft.
Large common logs, 1-3 off above prices.	
Small clear and common saw logs.....	12 to 20 per 1,000 bd. ft.
Cull saw logs	8 to 12 per 1,000 bd. ft.
22-inch (length) heading bolts, clear, 8 to 20 inches diameter	15 to 20 per 1,000 bd. ft.
35-inch (length) stave bolts, clear, 8 to 20 inches diameter	15 to 20 per 1,000 bdf. ft.
24-inch (length) rim bolts, clear, 8 to 29 inches diameter	15 to 20 per 1,000 bd. ft.
28-inch (length) spoke bolts, clear, 8 to 20 inches diameter	15 to 25 per 1,000 bd. ft.
40-inch (length) handle bolts, 6 inches and up.....	10 to 15 per 1,000 bd. ft.
Railroad ties	15 to 20 per 1,000 bd. ft.
Slack cooperage bolts	5 to 10 per 1,000 bd. ft.
Chestnut oak* bark	8 to 10 per cord.

(1,000 feet of saw logs will yield from half a cord to a cord of bark.)

*Chestnut oak seldom produces select logs, but it is the only oak whose bark is valuable for tanning material. Otherwise it is not different from white oak in its utilization.

Red Oak—

Large, clear red oak logs should go to saw and veneer mills; medium sized and small clear logs should go into rim stock, spoke stock, and oil barrel staves and heading; common and cull logs should usually be sold to local saw mills or slack cooperage plants, or should be hewed into ties. The following is a summary of the values of different classes of red oak material delivered f. o. b. cars, or on water, or to local mills:

Large select saw and veneer logs—

28 inches and up in diameter.....	\$25 to \$40 per 1,000 bd. ft.
24 to 28 inches in diameter	23 to 28 per 1,000 bd. ft.
18 to 24 inches in diameter	18 to 23 per 1,000 bd. ft.
14 to 17 inches in diameter	15 to 18 per 1,000 bd. ft.
Large common logs 1-3 off of above prices.	
Small saw logs of all grades.....	7 to 15 per 1,000 bd. ft.
22-inch oil heading bolts	} 10 to 15 per 1,000 bd. ft.
24-inch rim bolts	
36-inch oil stove bolts	
20 to 30-inch wagon and auto spoke bolts.....	
Slack cooperage bolts.....	4 to 8 per 1,000 bd. ft.
Railroad ties, finished (where there happens to be a market)	8 to 12 per 1,000 bd. ft.

Poplar—

Yellow poplar is a common woodlot tree throughout the State. Its leading use is for saw and veneer logs. Poplar saw logs will always net the farmer more money than oak logs of similar size and quality because they are much lighter and cheaper to handle and transport. Furthermore, poplar logs, both small and large, cut out a much higher average of upper grades of lumber than do oak logs. The average value of poplar lumber cut in Kentucky mills is about \$6 higher per 1,000 board feet than oak, and from \$8 to \$12 higher than chestnut, gum, and yellow pine. This usually makes it profitable to saw much smaller logs of poplar than of other species. Poplar bolts of a minimum diameter of 12 inches are utilized for fruit package veneers; of 6 inches for crating; and of 4 inches for excelsior and wood pulp bolts. Small, straight and clear poplar logs 10 feet long and from 6 to 16 inches in diameter at the top end can sometimes be sold profitably for turned porch columns, for which purpose they bring \$10 per 1,000 board feet.

The value of poplar logs and bolts delivered f. o. b. cars or on water or at mills on railroad or water transportation is as follows:

Large select saw and veneer logs—

28 inches and up in diameter	\$30 to \$40 per 1,000 bd. ft.
24 to 28 inches in diameter	25 to 30 per 1,000 bd. ft.
20 to 24 inches in diameter	20 to 25 per 1,000 bd. ft.

(1-3 off of above prices for common logs.)

(1-2 off of above prices for cull logs.)

Small select and common saw logs.....\$15 to \$20 per 1,000 bd. ft.

(Poplar yields few if any small cull logs.)

Wool pulp, excelsior, and small veneer and crating

bolts \$8 to \$14 per 1,000 bd. ft.

Hickory—

Like oak and poplar, hickory is an abundant and important woodlot tree throughout the State. In general, the best prices are received for vehicle stock and handles. Large hickory timber, however, yields the highest profits if sold as stock for shafts, poles, cross bars, reaches, single and double trees, neck yokes, etc. Medium-sized trees can be marketed as saw logs or as spoke or single and double tree bolts and billets. Small trees, 15 inches or less in diameter breast high, yield the best returns if marketed as logs or bolts for ax handles. The prices of hickory logs and bolts delivered at factories and mills in Kentucky range as follows:

Large clear logs\$25 to \$30 per 1,000 bd. ft.

Small clear logs 20 to 25 per 1,000 bd. ft.

Common logs and bolts 10 to 20 per 1,000 bd. ft.

Cull logs and bolts have practically no value except for fuel.

Hickory logs always cut a large per cent of merchantable cull lumber—frequently 50 per cent from apparently sound logs—which keeps down the price.

Beech—

Beech never commands a high stumpage value and its most profitable use is for saw logs. It is also used for slack cooperage and for boxes and crates. In cutting logs there is much waste because of defect and because the clear logs, suitable for flooring, are often the only ones which it will pay to take out. It makes good fuel, however, and where there is a firewood market beech wood can always be sold.

Beech logs, delivered at the mill, seldom bring over \$12 per 1,000 board feet. Standing beech timber sells for only from \$1 to \$4 per 1,000 board feet, averaging \$2.50. In some localities it has a stumpage value for slack cooperage bolts and firewood of from 50 cents to \$1 per cord.

Chestnut—

Chestnut is important chiefly in the Cumberland, Blue Grass, and Central Highland regions. It is usually sold as saw logs, shingle bolts, poles, extract wood, and slack cooperage logs and bolts. Large, clear chestnut logs (20 inches and over in diameter at the top end) bring from \$15 to \$20 and small logs from \$6 to \$12 per 1,000 board feet delivered at local mills. Shingle bolts sell at local mills for from \$15 to \$20 per 1,000 board feet. Logs suitable for poles (straight logs 20 feet and over in length by 6 or 8 inches in diameter at the top end, and with the bark removed) bring better prices, ranging from \$20 to \$40 per 1,000 board feet. In the southeastern quarter of the State extract wood brings from \$3 to \$4 per cord (5x4x8 feet) f. o. b. cars, but there is no market for it in the western half. Chestnut, delivered at the plants, is worth nearly as much for slack cooperage logs and bolts as for saw logs. Chestnut is lighter and cheaper to handle than oak; but there is often much waste due to unsoundness.

Sweet (or Red) Gum—

Sweet gum is important chiefly in the Western Coal Field and Western Lowland regions. In the woodlots, most of it is sap gum and only exceptionally is old growth to be found which will cut out red gum lumber. It finds a market chiefly as saw and veneer logs, veneer crating, slack cooperage and pulpwood bolts, and railroad ties. Gum logs and bolts are worth about as follows delivered at mills and factories in the State, or in rafts ready for water transportation:

Large select logs 20 inches and over in diameter are worth from \$15 to \$20 per 1,000 board feet, f. o. b. cars or at mills.

Common and select logs 14 inches and over in diameter are worth from \$8 to \$15 in rafts on the Tennessee and Cumberland Rivers, or delivered at local saw-mills, or at basket, package, and cooperage plants.

Common logs and bolts from 6 to 14 inches in diameter are worth from \$8 to \$9 per 1,000 board feet delivered at saw mills and at crate and cooperage plants.

Sweet gum ties delivered on the bank of the Tennessee River, are worth from 20 to 30 cents apiece, or from \$6 to \$8 per 1,000 board feet.

Red Cedar—

In the outlying portions of the Blue Grass region, on rough limestone lands, red cedar is often a woodlot tree of the first importance. For posts and small squares it is so valuable that it can be utilized to smaller sizes than any other tree. It is sold chiefly as saw logs, posts, and poles. Most of the cedar left on farmers' woodlots is comparatively small sap or white cedar, which can be marketed for posts and squares from 7 to 10 feet long. The small logs—upwards of 3 inches in diameter at top and 7 feet long—from which these pieces can be cut, bring from \$10 to \$20 per 1,000 board feet (mill scale). The posts and squares when sawed out sell for from \$30 to \$60 per 1,000 feet on cars at local stations, the best being sold for turned porch columns. The next most important use for cedar and the most profitable, where it is large enough, is for poles, which bring about the following prices delivered at local stations:

20-foot poles, 6-inch top.....	\$1.60	} Equivalent to \$40 per 1,000 board feet of squares and posts which could be cut.
25-foot poles, 6-inch top.....	2.00	
28-foot poles, 6-inch top.....	2.30	
30-foot poles, 6-inch top.....	3.50	} Equivalent to \$50, \$70 and \$90, respectively, per 1,000 board feet of possible squares.
40-foot poles, 6-inch top.....	8.00	
60-foot poles, 8-inch top.....	28.00	

The manufacture of red cedar pencil stock requires red or heartwood. This is found only in comparatively large and very old trees, which are scarce. Old red cedar rails, and stumps of large trees, however, can sometimes be disposed of for pencil stock. Material for pencil stock brings from 15 to 20 cents per cubic foot of red wood, or from \$20 to \$30 per 1,000 board feet, mill scale. Cedar

logs for other purposes, such as lumber for chests, wardrobes, cabinets, coffin boxes, and buckets, bring about the same prices.

Yellow Pine—

Shortleaf and scrub pines, the former furnishing most of the native yellow pine lumber, are limited to the Cumberland region, the poorer portions of the Central Highlands east of the Tennessee River, and the rough, knobby land which surrounds the Blue Grass region. There is very little yellow pine in woodlots in the State that will make good shipping lumber; and most of it is sold locally, the saw logs to local mills, and the small stuff to slack cooperage plants and to box and crating plants, if there are any such in the locality. For local consumption and at planing mills common pine dimension lumber and boards bring from \$10 to \$15, and select boards \$20 per 1,000 board feet, which makes the logs delivered at mills worth about \$5, \$10, and \$15 per 1,000 board feet. It is much cheaper to handle pine than oak; and at local mills pine logs will usually bring a better net price than common oak logs. Large clear pine logs can sometimes be most profitably sold to veneer mills, when such are located nearby. For this purpose they bring from \$15 to \$20 per 1,000 board feet, delivered.

Basswood, Elm, Maple, Sycamore, Buckeye and Black Gum—

Basswood, elm, maple, sycamore, buckeye, and black gum are comparatively unimportant in farm woodlots in the State because of either their scarcity or their low value. Basswood is the most valuable. Wherever large enough, good logs of these species will bring the best profit if sold to saw mills. Small, common stuff can be used for slack cooperage. Basswood is as valuable as poplar for pulpwood and excelsior. Elm, maple, sycamore, and buckeye can sometimes be profitably cut into bolts for slack cooperage, veneer, crating, and packages; for these it brings from \$6 to \$12 per 1,000 board feet, log scale, at the factory. Black gum is put into bolts for veneer and wagon hubs.

Ash, Walnut and Cherry—

In Kentucky these woods are usually most valuable for saw logs. Ash of small size, however, is often most valuable for handles, boat oars, pump sucker rods, and butter tub staves and heading, depending upon its proximity to factories producing these articles.

Black Locust, Dogwood, and Persimmon—

Black locust, dogwood and persimmon occur in small quantities in woodlots throughout the State. As a rule they are too small for lumber, but they are of considerable value for other purposes. Black locust, when large enough, is chiefly valuable for posts and poles. Black locust posts are worth from 15 to 20 cents apiece delivered, which, figuring 6 board feet per post, is equivalent to from \$25 to \$35 per 1,000 board feet of lumber. Black locust bolts can sometimes be sold very profitably for insulator pins, for which they bring a little more than for posts. Dogwood and persimmon are valuable chiefly for shuttle stock, for which they bring from \$8 to \$12 per cord of 160 cubic feet; sticks as small as 4 inches at the top end and 5 feet in length are accepted. This is equivalent to from \$16 to \$24 per 1,000 board feet of lumber.

LUMBER AND LOG VALUES.

Lumber—Most of the Kentucky lumber shipped out of the State goes to Cincinnati or to the big lumber markets north and east of Cincinnati. At Cincinnati the average prices of 1-inch lumber of different kinds, grades, and widths during the months of July, August, and September, 1915, were as shown in Table 3, according to a report of the Lumberman's Bureau. These prices usually run from \$1 to \$3 higher than they do at Kentucky points, since they cover a greater freight charge. The farmer can use current Cincinnati prices, after deducting this freight charge, as a basis for figuring the values of his logs or stumpage in the way described on pages 109 to 120, under "Cost of Production and Net Profits." It would be necessary to estimate the proportion of different grades his timber would

Table 3. Prices¹ of hardwood lumber, one inch and up in thickness, f. o. b. Cincinnati—Variations in price within grades are due to difference in widths and thicknesses.*

	1sts. and 2nds.	No. 1 Common	No. 2 Common	No. 3 Common	Log Run (Mill Culls Out)
Ash	\$45.00—\$71.00	\$30.00—\$50.00	\$19.00—\$25.00	\$12.00—\$15.00	—
Basswood	36.00—43.00	26.00—32.00	19.00—25.00	16.00—18.00	\$24.00—\$29.00
Beech	23.00—27.00	17.00—21.00	13.00—17.00	13.00—15.00	18.00—22.00
Birch	52.00—56.00	42.00—46.00	28.00—31.00	18.00—19.00	29.00—32.00
Buckeye	32.00	20.00	13.00	—	20.00
Butternut	56.00	25.00	14.00	—	25.00
Cherry	86.00—114.00	46.00—69.00	14.00—22.00	—	—
Chestnut	43.00—47.00	28.00—31.00	16.00—19.00	8.50—9.50	—
Hickory	49.00—74.00	28.00—44.00	17.00—29.00	—	—
Walnut	108.00—143.00	52.00—75.00	28.00—38.00	—	—
Sycamore, plain	29.50	20.50	14.00	—	20.50
Sycamore, quartered	44.00	34.00	—	—	—
Plain Oak**	50.00—74.00	30.00—42.00	21.00—27.00	13.00—14.00	—
Quartered White Oak**	75.00—118.00	45.00—54.00	26.00—29.00	—	—
Quartered Red Oak**	59.00—72.00	38.00—42.00	24.00	—	—
	1sts. and 2nds	Sap and Select	No. 1 Common	No. 2 Common	No. 3 Common
Poplar	\$53.00—\$66.00	\$38.00—\$50.00	\$23.00—\$42.00	\$18.00—\$26.00	\$14.50
Poplar Panel (18 to 28 inches wide)	18.00—28.00	62.00—102.00	—	—	—
Poplar Wagon Box (8 to 17 inches wide)	8.00—17.00	28.00—58.00	—	—	—
	1sts. and 2nds.	Red	Sap	Sap	Sap
		No. 1 Common	1sts. and 2nds.	No. 1 Common	No. 2 Common
Gum	\$21.00—\$37.00	\$21.00—\$27.00	\$22.00—\$26.00	\$18.00—\$22.00	\$16.00—\$17.00
Wide Gum	25.00—60.00	—	—	—	—
(Wagon Box and Panel Stock)					

¹According to market report, Lumberman's Bureau, Oct. 1, 1915.

*The first and lower price given in each case is for one inch thick lumber. The higher prices are largely for thicker lumber, for which there is not such a ready market as for inch stock, and on which the carrying charges are usually greater.

**Not including oak lumber 2½—5½ inches wide of the 1st and 2nd and No. 1 common grades, the price of which is from \$10 to \$20 less.

cut, as well as cost of producing the lumber from the stump to f. o. b. railroad. Where this can be done it gives the stumpage owner a substantial basis for negotiating with mill men or other purchasers so as to secure the full value of his timber. It should be borne in mind that timber which cuts out an average of No. 1 common in grade is above the average in quality.

Logs—Table 4 gives average prices paid for select logs of different kinds and sizes delivered at veneer mills, based on data collected by the Forest Service in 1914; and Table 5 gives the range in price paid by large saw mills f. o. b. local stations for select logs. It should be borne in mind that the prices given in Table 4 are not actual market prices but are merely a basis for judging the value of select woodlot trees. Ash, which is not included in the table, is usually between white and red oak in price. The prices of yellow poplar in Indiana are not given because they are lower than in Kentucky. The values of common and cull logs are usually about two-thirds and one-half respectively as much as those of select logs of the same kinds and sizes.

Table 4. Average prices for veneer logs of different kinds and sizes delivered at factories in Kentucky and Indiana.

	17 inches and under	18-24 inches	25-28 inches	29-34 inches	35 inches and up
Yellow Poplar					
Kentucky	\$22.00	\$32.00	\$34.65	\$38.50	\$45.50
White Oak					
Kentucky	20.00	30.00	36.50	41.65	46.00
Indiana	25.50	37.50	49.00	55.50	-----
Red Oak					
Indiana	22.60	25.00	37.50	45.00	-----
Walnut					
Kentucky	42.00	60.00	71.00	-----	135.00
Red Gum (log run, common and select)					
Indiana	13.52	17.50	18.50	20.00	22.10
Maple (log run, common and select)					
Indiana	15.50	16.50	17.60	18.00	18.00
Sycamore (log run, common and select)					
Indiana	14.00	15.50	16.00	18.00	-----
Beech (log run, common and select)					
Indiana	10.30	15.70	16.26	17.00	18.00
Chestnut—Kentucky	\$25.00 average for all sizes, select logs				
Yellow Pine—Kentucky	\$24.00 average for all sizes, select logs				

Table 5. Range in prices of select saw logs of different sizes, f. o. b. railroad.

Diameter at top end	White Oak* Poplar	Walnut
12—15	-----	\$40— 50
16—17	\$16—20	50— 60
18—19	18—22	60— 70
20—21	20—24	70— 80
22—23	22—26	80— 90
24—25	24—28	90—100
26—27	26—30	100—110
28—29	28—32	110—120
30—31	30—35	120—130
32—33	35—40	
34 and up	40—50	

*Red oak logs 30 inches and over are from \$5 to \$10 less, and logs under 30 inches are from \$1 to \$5 less.

HOW TO INCREASE PROFITS FROM WOODLOT SALES.

Success in woodlot sales, as in marketing agricultural crops, depends upon thorough acquaintance with the various markets, requirements, and prices, and business-like attention to the details of estimating or measuring, grading, negotiating, and contracting. The farmer who owns timber should not part with it without being satisfied that he is getting the best possible price for every bit of each kind sold. There is usually no need for haste in harvesting and marketing trees. When the market is down, they may be held for more favorable conditions; and in any event there is time for a thorough consideration of the marketing possibilities.

The farmer who increases his store of information along any of the following lines will increase his chances of marketing his products profitably: (1) Methods of sale; (2) log and lumber scaling and grading; (3) estimating standing timber; (4) markets; (5) cost of producing and delivering the different kinds and classes of material to the available markets; (6) making contracts; (7) co-operation with neighbors.

I. METHODS OF SALE.

There are four general ways in which woodlot products may be sold: (1) by the boundary, for a lump sum; (2) by scale measurement of rough products, using the different log, cord, and rick scales; (3) by the piece, for such products as ties and poles; and (4) by lumber scale of sawed products.

To sell advantageously by the boundary for a lump sum requires a careful estimate of the amount and value of the standing timber; otherwise, sale by scale measurement or by the piece is preferable. Selling by the boundary, however, gives the seller the least trouble, except where restrictions are made in regard to the number, kinds, and size of trees to be cut; these would necessitate supervision to prevent violations.

Profitable selling by scale measurement requires a thorough knowledge of (1) the scale to be used; (2) of the size and grade specifications of the kinds of material

which are to be sold, and (3) an agreement in writing in regard to the application of the scale.

In small timber, selling by the cord or rick is preferable to selling log-scale (see Table 7, page 99). It is a comparatively simple way of marketing. With some classes of material, such as firewood, pulpwood, and excelsior wood, it is used exclusively.

Selling by the piece is also comparatively simple and it is the only method under which some classes of material such as ties, poles, piles, etc., are sold. The important thing is to know the specifications and relative values of the different grades of each class of products so as to utilize the timber cut to the best advantage.

Selling by lumber scale includes both selling logs at local mills on the basis of the actual amount of lumber they turn out and the selling of lumber which the farmer has himself sawed out or had sawed by a portable mill operator. It is especially advantageous to sell small logs in this way. Selling sawed lumber through the agency of a portable mill set up in the woodlot, is an excellent way of marketing under certain conditions, but it is not much practiced at present in Kentucky. It dispenses with the necessity of an accurate estimate of the standing timber and of the grading of the logs, and may result in a considerable saving to the farmer, especially on common and cull logs which he could not haul out of his woodlot at a profit. The low grades of lumber, of little or no market value, can be kept at small cost for use on his farm or for local disposal, and the better grades can often be sold for shipping lumber at prices which will net as much as if all the timber were sold standing or in the log. Or he may fill special orders for local house or barn construction, or for special stock for shipment to wood-using industries, such as dealers in hickory whiffle-tree squares, spoke squares, or handle stock, oak felloe stock, tight cooperage stock, or car and bridge timbers, ash base ball bat or long handle stock, dogwood and persimmon shuttle blocks, cedar squares and posts, and locust insulator pins. It will usually be possible to have the milling done by contract, but the farmer should attend to the logging himself and keep an eye on the milling.

When selling by lumber scale, the farmer will find it greatly to his advantage to have as complete a knowledge as possible of sawing, scaling, and grading lumber. Scaling is relatively simple, but grading is a complicated subject, requiring considerable experience, and there is much room for difference in judgment of the grades. If the lumber is sold at the tail of the mill, the farmer should protect himself either by employing an experienced grader or by studying the grading rules to an extent sufficient to detect gross errors. The standard grading rules in Kentucky are those of the Hardwood Manufacturers' Association, and a copy can be secured on application to the Secretary of the Association, Cincinnati, Ohio.

II. SCALING AND GRADING LOGS AND BOLTS.

Scaling Logs—

For obtaining the lumber contents of logs of different sizes there are a number of log rules, of which the Doyle-Scribner* is the most generally used in Kentucky. It is a combination of the Doyle rule, for logs 28 inches and under, and the Scribner rule, for logs over 28 inches. The volumes which it gives are those indicated by heavy-faced type in Table 6. It will be seen that this combination of the two is in the interest of the buyer of logs, as it gives a lower scale than either rule does taken separately. It would be fairer to combine these rules the other way around, making a Scribner-Doyle rather than a Doyle-Scribner combination, in which case the seller of logs would get from 25 to 100 per cent more scale for logs 12 inches and under in diameter than he does by the Doyle Scribner rule.

For scaling logs rafted by river the Cumberland River Rule† is commonly used in the State. This rule is even more unfair to the seller than the Doyle-Scribner except on logs less than 12 inches in diameter.

*This Doyle-Scribner rule is often erroneously called the Doyle rule, and sometimes the Scribner rule.

†this rule was constructed for measurement of hardwood logs in the water in the Mississippi River and its tributaries. These logs are often defective and in the water it is impossible to distinguish the defects hidden by the water itself, and by mud, sand, plugs, etc. This log rule is supposed to allow for all such hidden defects, and it would be manifestly unfair when applied to fairly sound and good logs.

For comparison with the Doyle, Scribner, and Champlain River rules the Champlain rule, which is not in use in the State, is also given in Table 6. This rule is made for sound and straight logs and shows what it is possible for the mill man to saw out of such logs with careful manufacture. It is especially important to note in this table that the scale for small logs from 6 to 10 inches in diameter by the commonly used Doyle rule is from one-half to one-fifth as much as by the Champlain rule. In using the Doyle rule for small logs the mill man, or purchaser of logs, may argue that the great overrun in mill scale which he gets from them does not more than counterbalance the greater cost of manufacture and the lesser value of the lumber produced from small than from large logs, in which statement there is a certain amount of truth. But the difference in value of large and small logs is often fully provided for by difference in price, in which case there is no reason for the very much too small scale allowed for them by the Doyle rule.

The scaling is done by measuring the length of the log and its average diameter inside bark at the top end, and then recording from the log rule the lumber contents given (or the dimensions of the log). Buyers often scale logs on the basis of the smallest diameter, instead of the average, which is obviously to the disadvantage of the seller. Logs are scaled to full inches in diameter inside bark; a fraction of one-half inch and less is thrown out; a greater fraction is read as a full inch. The contract of sale (pp. 120 to 121) should be definite in these particulars, as well as in those relating to grading the logs, deducting for defect, etc., which follow.

Scaling Bolts in Log Measure—

When the wood is to be sold as stock for cooperage, veneer, handles, pulp, or excelsior, the farmer will often have the choice of selling it as small logs by log scale, or by the cord of short bolts. In order to determine the comparative advantage of selling small logs, 12 inches and less in diameter at the top end, by the standard cord (4x4x8 feet in size, containing 128 cubic feet), the figures in Table 7 may be used. These will apply only when the length of bolt which would be re-

quired if the wood were cut into bolts is 4 feet. If greater or less than 4 feet, so that a stack 4 feet high and 8 feet long would contain more or less than 128 cubic feet, the figures should be proportionately increased or reduced. The decision whether to sell in logs or bolts must, of course, take into account the greater cost of cutting into bolts than into logs.

Table 7. Number of cords of round wood bolts (4 feet long) contained in 1,000 board feet of 16-foot logs of different top diameters when scaled by Doyle, Scribner and Champlain log rules.

Top Diameter of Logs Inside Bark, in Inches	Number of Cords in 1,000 Board Feet of Logs		
	Logs Scaled by Doyle Rule	Logs Scaled by Scribner Rule	Logs Scaled by Champlain Rule
A. Cords of Unpeeled Wood.			
4	.....	5.0	5.6
5	59.2	4.6	4.2
6	18.4	4.1	3.3
7	9.8	3.7	2.8
8	6.6	3.3	2.5
9	4.9	2.9	2.2
10	3.9	2.6	2.0
11	3.3	2.5	1.8
12	2.8	2.3	1.7
B. Cords of Peeled Wood.			
4	.....	3.8	4.3
5	46.0	3.5	3.3
6	14.7	3.3	2.7
7	8.1	3.0	2.3
8	5.6	2.8	2.1
9	4.2	2.5	1.9
10	3.4	2.3	1.8
11	2.9	2.2	1.7
12	2.5	2.1	1.6

Grading Logs—

There is considerable variation in the practice of grading logs. They are commonly graded as select, common, and cull, depending on their relative clearness and the proportion of different grades of lumber which they will produce. A common log brings at the mill about two-thirds as much as a good log, and a cull log half or

even less. Sometimes the cull logs are rejected entirely. In general the three classes may be defined as follows:

1. *Select Logs*.—Logs which will saw out 75 per cent of No. 1 Common or better, or 50 per cent 1 and 2 Select lumber. Small logs must be practically clear and free from defects, while from one to three small or medium sized knots are admitted on medium sized or large logs, or one large knot if near the end of the log.

2. *Common Logs*.—Logs which will cut 75 per cent No. 2 Common and better or 50 per cent No. 1 Common and better. This includes logs with from one to three large knots, depending upon the size of the log, or with a number of small tight knots whose total area will not exceed that of from 1 to 3 large knots.

3. *Cull Logs*.—Logs which will not cut 75 per cent No. 2 Common and better. This includes all large knotted logs which will cut out only No. 2 Common and cull lumber.

At large mills located in large towns and cities more grades are often recognized; and the prices paid for logs of the good or select grade of valuable species vary greatly according to size of the logs. (See Table 5.)

Deduction for Defect—

In the contract of sale, stipulations should be made as to the amount to be deducted from the log scale in allowing for visible defects, such as crookedness and unsoundness. The Forest Service (U. S. Dept. of Agriculture) Manual for Scaling Timber (1915) contains the following instructions for deducting for defect:

Deductions should not be made for defects outside of the cylinder represented by the top end and total length of the log or for defects in the portion of the log which will be slabbed off. Otherwise deductions should be made in scaling for all visible defects which will actually reduce the yield of lumber from the log. This includes crooks and any defective or waste material whose presence is plainly indicated on the surface of the log by conks, rotten knobs, pitch seams, etc. There must, however, be an unmistakable surface indication of the defect. The scale should never be reduced simply because defect frequently appears in sawing.

The total scale of the log will be reduced in each instance by the estimated loss in lumber from the defects present in the cylinder

as compared with a sound cylinder of the same dimensions. Reductions will not be made for defects in the swell of the log outside of the cylinder. Scalers should reduce the scale for all other defects regardless of overrun.

Deductions will not be made for "sound" defects, such as sound knots, however large, and firm rot, which affect the grades of lumber but do not reduce the total cut from the log. Deductions will be made only for crooks, curve, or sweep, and checks, worm holes and pitch rings.

The percentage of waste from sweep or curve varies with the diameter of the log. A curve of 3 inches in a 10-inch log will cause approximately twice the proportionate waste as the same curve in a 20-inch log. Sweep which would cull a very small log would not necessarily cause the rejection of a large log.

The scaler should sight along a curved log, noting where the saw will square it sufficiently to cut boards on both sides affected by the curve. In determining the amount of loss it should be remembered that material near the slab saws out narrow boards containing fewer feet than those cut from any other part of the log.

No deduction should be made for curve or sweep in logs over 16 feet long.

III. ESTIMATING STANDING TIMBER.

A proper estimate of the woodlot involves the determination of the contents of all the trees in it in terms of the most common forms in which timber is marketed, such as logs, bolts, poles, ties, etc. The determination of the units in which to estimate the timber requires some general knowledge of the market requirements as to form, size, etc., for the different kinds of trees. Often two or more units should be used for a single tree. Thus a large white oak might yield a fine, clear veneer log, valuable enough to be shipped a long distance, and in addition, one or two common logs suitable for local manufacture, some railroad ties, and some posts and cordwood. Again, the same part of the tree might appear to be about equally valuable for several purposes, in which case a separate estimate should be given it for each purpose. Hickory, for example, can advantageously be estimated in terms both of cords of handle material and of board feet of vehicle stock, provided it is marketable for both of these uses. Usually, however, the purpose of which the tree is most valuable can be determined in

advance, and the estimate made with reference to this one use.

A simple method of estimating is to record the diameter and length of each piece or tree and from these two figures determine the volume of the piece in the desired form by the use of the log rule and volume tables. (Tables 6, 8, 9, 10 and 11). While an expert may be able to size up the contents of the trees at a glance, recording them directly as he proceeds with the estimating, the methods of volume and log rule tables are much preferable for the average farmer. The work is not difficult, but it is impossible to put too much care into it; a careless estimate will mislead and is likely to be worse than none. For recording the estimated diameters and lengths a form similar to that shown in Table 12 is convenient. It provides spaces for recording dimensions for scaling by both the log rule and the volume table method. The log rule method is the more accurate and it should be used for valuable timber. The diameter and lengths of the logs of different grades and sizes are recorded separately for each tree. When, as is sometimes the case, only one grade or one class of material is contained in the woodlot, the recording is simplified, as, for example, when the logs are fit only for common or small lumber, or when the material is suitable or is to be used entirely for ties, poles, piles, etc.

The diameter breast-high (outside bark at $4\frac{1}{2}$ feet from the ground) is important, since it affords a good basis for judging the diameters at the log ends. On valuable timber, at least, it should be actually measured, rather than estimated.* Top diameters of logs, bolts, etc., must, of course, be estimated. The double bark thickness should be deducted and the estimate recorded as inside bark. In estimating top diameters it is useful to have in mind an idea of the approximate rate at which the tree tapers. A good general rule for ordinary trees over 12 inches breast-high is to assume that the diameter inside bark at stump height is the same as that outside bark at breast-height, and then allow about 3 inches

*The measuring can be done by means of tape, caliper, or measuring stick. For a description of the use of these implements, see Forest Service bulletin —, "Measuring and Marketing Woodlot Products."—A Farmer's Bulletin (in press.)

Table 8. Contents in number of board feet of hardwood trees of different diameters and number of merchantable logs.

(Stump height, 2 feet. Trees over 75 years old.

Scribner Decimal C rule.)

Diameter Breast High Inches	Number of 16-foot Logs									Diameter Inside Bark of Top Inches	Basis Trees
	1	1½	2	2½	3	3½	4	4½	5		
	Volume—Board Feet										
8	20	27	35	43	.....	.....	.....	.....	.....	6	.....
9	20	32	42	53	.....	.....	.....	.....	.....	6	1
10	20	36	52	64	81	.....	.....	.....	.....	6	2
11	21	43	62	78	98	120	.....	.....	.....	6	4
12	23	50	73	93	120	140	180	.....	.....	6	3
13	25	58	86	110	140	170	200	.....	.....	7	4
14	27	67	100	130	160	190	230	280	.....	7	9
15	30	77	120	150	180	220	260	300	.....	8	15
16	34	89	130	170	200	250	290	340	390	8	18
17	38	100	150	190	230	280	320	380	440	9	40
18	43	120	170	210	260	310	360	420	490	9	56
19	48	130	200	240	290	350	400	470	540	10	65
20	54	150	220	270	330	390	450	520	590	10	75
21	62	170	250	300	370	440	500	580	650	11	86
22	69	190	270	340	410	480	550	640	720	11	90
23	77	210	300	380	450	530	610	700	790	12	67
24	85	230	340	420	500	580	670	770	860	12	80
25	93	250	370	460	550	640	740	840	940	13	56
26	100	280	410	510	600	700	810	910	1,020	13	89
27	110	300	450	560	660	770	880	990	1,110	14	68
28	120	330	490	610	720	830	960	1,080	1,200	14	81
29	130	360	530	660	790	900	1,030	1,160	1,300	15	61
30	140	390	580	720	850	980	1,120	1,250	1,400	15	47
31	.....	420	630	770	910	1,050	1,200	1,350	1,510	16	45
32	.....	450	690	830	980	1,130	1,290	1,450	1,620	16	40
33	.....	480	740	890	1,050	1,211	1,380	1,560	1,730	17	49
34	.....	.....	800	950	1,120	1,293	1,480	1,670	1,860	17	30
35	.....	.....	860	1,010	1,180	1,380	1,570	1,790	1,990	18	22
36	.....	.....	920	1,070	1,250	1,460	1,680	1,910	2,140	18	17
37	.....	.....	.....	1,130	1,320	1,550	1,780	2,040	2,290	19	24
38	.....	.....	.....	1,190	1,390	1,640	1,890	2,170	2,450	19	11
39	.....	.....	.....	1,250	1,460	1,720	2,000	2,300	2,600	20	16
40	.....	.....	.....	1,310	1,540	1,820	2,120	2,430	2,760	20	15
41	.....	.....	.....	.....	1,610	1,910	2,240	2,570	2,930	21	6
42	.....	.....	.....	.....	1,680	2,000	2,360	2,720	3,100	21	3
43	.....	.....	.....	.....	1,750	2,090	2,470	2,860	3,270	22	3
44	.....	.....	.....	.....	1,830	2,180	2,590	3,010	3,450	22	2
											1,300

Correction Factors for Different Species.

Chestnut—For diameters of 0 to 40 inches, subtract 10 per cent.

Chestnut Oak—For diameters of 32 to 40 inches, add 10 per cent.

Red Oak—For all diameters use the table without change.

White Oak—For diameters of 18 to 40 inches, add 10 per cent.

Yellow Poplar—For diameters of 8 to 40 inches, add 0 per cent.

Table 9. Contents in board feet of coniferous trees of different diameters and heights.

(Stump height, 2 feet. Diameter (inside bark) of top, 6 inches.
Trees over 75 years old. Scribner Decimal C rule.)

Diameter Breast High Inches	Total Height of Tree—Feet										Basis Trees
	60	70	80	90	100	110	120	130	140	150	
	Volume—Board Feet										
8	27	31	38	46	63	-----	-----	-----	-----	-----	12
9	33	47	54	64	80	-----	-----	-----	-----	-----	9
10	51	63	71	84	100	110	-----	-----	-----	-----	12
11	65	80	91	110	120	140	-----	-----	-----	-----	13
12	80	98	110	130	150	170	-----	-----	-----	-----	8
13	96	120	140	160	180	200	-----	-----	-----	-----	4
14	110	140	160	180	210	240	270	-----	-----	-----	7
15	130	160	190	220	250	280	310	-----	-----	-----	11
16	160	190	220	250	280	320	350	380	-----	-----	20
17	180	210	250	290	320	360	400	440	-----	-----	21
18	210	240	290	330	370	410	450	490	-----	-----	20
19	240	280	320	370	410	460	500	550	-----	-----	34
20	270	320	360	420	470	520	560	620	680	-----	27
21	310	360	410	470	520	580	630	690	750	-----	33
22	350	410	460	520	580	640	700	760	830	-----	40
23	390	460	520	580	640	710	770	840	910	-----	37
24	440	510	570	640	710	780	850	920	1,000	1,080	37
25	-----	570	640	700	780	850	930	1,000	1,080	1,190	47
26	-----	630	700	770	840	920	1,010	1,090	1,190	1,290	52
27	-----	690	770	840	920	1,000	1,100	1,180	1,290	1,400	43
28	-----	760	840	910	990	1,080	1,180	1,290	1,390	1,510	45
29	-----	830	910	990	1,070	1,160	1,260	1,370	1,500	1,630	39
30	-----	900	990	1,070	1,150	1,240	1,350	1,470	1,610	1,760	47
31	-----	-----	1,070	1,150	1,230	1,330	1,450	1,580	1,730	1,900	40
32	-----	-----	1,160	1,230	1,320	1,410	1,540	1,690	1,860	2,050	44
33	-----	-----	1,240	1,320	1,400	1,500	1,640	1,800	1,980	2,180	39
34	-----	-----	1,320	1,400	1,490	1,600	1,740	1,920	2,120	2,330	36
35	-----	-----	1,410	1,490	1,570	1,690	1,850	2,040	2,250	2,470	34
36	-----	-----	1,490	1,570	1,660	1,790	1,950	2,160	2,380	2,610	29
37	-----	-----	-----	1,650	1,740	1,880	2,060	2,270	2,510	2,760	25
38	-----	-----	-----	1,740	1,830	1,980	2,170	2,390	2,640	2,900	18
39	-----	-----	-----	1,820	1,910	2,070	2,270	2,500	2,770	3,050	18
40	-----	-----	-----	1,900	1,990	2,170	2,380	2,630	2,910	3,210	24
41	-----	-----	-----	1,990	2,080	2,270	2,490	2,750	3,050	3,360	11
42	-----	-----	-----	2,070	2,170	2,360	2,600	2,880	3,200	3,530	11
43	-----	-----	-----	2,260	2,460	2,710	3,010	3,350	3,700	4,060	7
44	-----	-----	-----	2,350	2,560	2,830	3,150	3,510	3,880	4,250	5
45	-----	-----	-----	2,430	2,660	2,960	3,300	3,670	4,060	4,450	5
46	-----	-----	-----	2,520	2,760	3,090	3,450	3,850	4,250	4,650	5
											973

Correction Factors for Different Species.

Hemlock—For diameters of 8 to 10 inches, add.....	10 per cent.
Hemlock—For diameters of 11 to 20 inches, add.....	22 per cent.
Hemlock—For diameters of 21 inches and up, add.....	20 per cent.
Red Spruce—For diameters of 8 to 10 inches, add.....	5 per cent.
Red Spruce—For diameters of 11 inches and up, add.....	25 per cent.
Shortleaf Pine—For diameters of 10 inches and under, add.....	15 per cent.
Shortleaf Pine—For diameters of 11 to 19 inches, add.....	25 per cent.
Shortleaf Pine—For diameters of 20 to 23 inches, add.....	35 per cent.
Shortleaf Pine—For diameters of 24 inches and over, add.....	40 per cent.
White Pine—For all diameters, use the table without change.	

Table 10. Contents in cubic feet, and number of cubic feet per cord, in hardwood trees of different diameters and total heights.

Diameter Breast High	Total Height of Tree—Feet									Number* Cu. Ft. Per Cord
	20	30	40	50	60	70	80	90	100	
Inches	Peeled Volume— Cubic Feet									
2	0.2	0.3	-----	-----	-----	-----	-----	-----	-----	63
3	.4	.6	.8	-----	-----	-----	-----	-----	-----	70
4	.7	1.1	1.5	1.8	-----	-----	-----	-----	-----	75
5	1.1	1.7	2.3	2.9	3.4	-----	-----	-----	-----	79
6	1.6	2.5	3.3	4.1	4.9	5.8	-----	-----	-----	83
7	2.2	3.4	4.5	5.6	6.7	7.9	9.0	-----	-----	85
8	2.9	4.4	5.9	7.3	8.8	10.3	11.7	13.2	-----	88
9	3.7	5.6	7.4	9.3	11.1	13.0	14.8	16.7	18.6	89
10	4.6	6.9	9.2	11.5	13.7	16.0	18.3	21.0	23.0	91
11	-----	8.3	11.1	13.9	16.6	19.4	22	25	28	92
12	-----	9.9	13.2	16.5	19.8	23	26	30	33	93
13	-----	11.6	15.5	19.4	23	27	31	35	39	94
14	-----	13.5	18.0	22	27	31	36	40	45	94
15	-----	15.5	21	26	31	36	41	46	52	95
16	-----	-----	23	29	35	41	47	53	59	95
17	-----	-----	26	33	40	46	53	60	66	95
18	-----	-----	30	37	45	52	59	67	74	95
19	-----	-----	33	41	50	58	66	74	83	96
20	-----	-----	37	46	55	64	73	82	92	96

Form factor .42.

*From Forest Service Bulletin 96, page 64.

Per cent. of Bark to Total Volume for Trees of Different Species and Diameters.

Species	Diameter breasthigh—Inches				
	6	12	20	30	40
	Per cent. of Bark				
Ash, black.....	18	16	13	10	9
Ash, green.....	22	17	13	10	
Ash, white.....	22	19	15	11	
Basswood.....	....	20	18	16	14
Beech.....	8	7	7		
Birch, yellow.....	....	13	13	13	
Maple, sugar.....	....	17	17	17	
Hemlock.....	15	17	18	19	
Hickories.....	21	17	15	13	
Poplar, yellow.....	21	17			

Table 11. Contents in cubic feet, and number of cubic feet per cord, in the tops (exclusive of branches) of hardwood trees of different diameters and total heights. By top is meant the portion of the stem above the merchantable length.

Diameter Breast High	Diameter at Top of Merch. Length	Total Height of Tree—Feet								Number Cu. Ft. Per Cord of Topwood
		50	60	70	80	90	100	110	120	
		Peeled Volume of Top—Cubic Feet								
Inches	Inches									
8	6	1.2	1.5	1.8	.....	.....	.....	.....	66
9	6	1.3	1.6	1.9	.....	.....	.....	.....	66
10	6	1.4	1.7	2.0	2.1	.....	.....	.....	66
11	6	1.5	1.9	2.2	2.3	.....	.....	.....	66
12	6	1.7	2.1	2.4	2.5	3.1	.....	.....	66
13	7	1.9	2.4	2.7	3.0	3.6	.....	.....	69
14	7	2.1	2.7	3.1	3.5	4.2	4.7	.....	69
15	8	2.3	3.1	3.5	4.0	4.8	5.4	.....	71
16	8	2.6	3.5	4.0	4.7	5.5	6.2	6.7	71	
17	9	2.9	3.9	4.6	5.4	6.3	7.0	7.6	74	
18	9	3.2	4.4	5.2	6.1	7.2	8.0	8.6	74	
19	10	3.6	4.9	5.9	6.9	8.1	9.0	9.8	77	
20	10	4.0	5.4	6.6	7.8	9.0	10.0	11.0	77	
21	11	4.4	5.9	7.3	8.7	10.0	11.1	12.3	79	
22	11	4.8	6.5	8.0	9.6	11.0	12.2	13.6	79	
23	12	5.3	7.1	8.8	10.6	12.2	13.4	15.0	81	
24	12	5.8	7.7	9.6	11.6	13.4	14.7	16.5	81	
25	13	6.3	8.3	10.4	12.6	14.6	16.0	18.0	83	
26	13	6.8	9.0	11.3	13.7	15.8	17.3	19.5	83	
27	14	.....	9.7	12.2	14.8	17.1	18.8	21	85
28	14	.....	10.4	13.2	16.0	18.5	20	23	85
29	15	.....	11.1	14.2	17.2	20	22	24	87
30	15	.....	11.9	15.2	18.5	21	24	26	87
31	16	.....	12.7	16.2	19.8	23	25	28	88
32	16	.....	13.5	17.3	21	25	27	30	88
33	17	.....	.....	18.4	23	26	29	32	90
34	17	.....	.....	19.5	24	28	31	34	90
35	18	.....	.....	21	26	30	33	36	91
36	18	.....	.....	22	27	31	35	38	91
37	19	.....	.....	.....	29	33	37	40	93
38	19	.....	.....	.....	30	35	39	42	93
39	20	.....	.....	.....	.....	37	41	45	94
40	20	.....	.....	.....	.....	39	43	47	94

TABLE 12. FORM FOR RECORDING MEASUREMENTS OF STANDING TIMBER.

Location and area : $\frac{1}{4}$ acre at east end of wood lot,
and representative of 10 acres.

Best Timber Trees	Diameter Breast- high Inches	MERCHANTABLE LOGS						REMARKS
		Select		Common		Cull		
		Length Feet	D.I.B. ⁱⁿ Inches	Length Feet	D.I.B. ⁱⁿ Inches	Length Feet	D.I.B. ⁱⁿ Inches	
<i>White Oak</i>	24	16	20	32	16	12	14	<i>Plus 3 ties; 6 posts.</i>
<i>Red Oak</i>	30			50	20			
<i>Hickory</i>	20	32	14					<i>Whiffle tree stock</i>
<i>Walnut</i>	25	16	20	16	18			<i>Plus 20 posts</i>
<i>White Oak</i>	30	24	24	30	18			<i>Plus 10 ties</i>
<i>White Oak</i>	16			50	6			<i>Piling only</i>
<i>Red Oak</i>	20			32	14			
<i>Hickory</i>	25	16	20					<i>Remainder Firwood</i>
<i>Chestnut</i>	20			60	6			<i>Pole only</i>
<i>Cedar</i>	15			40	6			<i>Pole only.</i>
<i>Etc.</i>								

* D.I.B. diameter inside bark at top end of log.

Less Valuable Trees.

Diameter Inches	White Oak	Red Oak	Hickory	Walnut	MISCELLANEOUS
4	/// (2)	//	///		/// (2)
6	//	/	//		+++ (2)
8	/ (2)	/	/		/// (2)
10	+++			+++ (2)	// (2)
12		/	/// (2)		// (2)
14	// (2)	//			// (2)
16		/	/		/ (2)
18	/	/			/ (2)
20					/ (2)

Circled Figures indicate average heights.

taper for the first 8 feet of log length above the stump and 1 inch taper for each succeeding 8 feet. For trees under 12 inches breast-high, one-half this amount should be allowed. Often, of course, there will be trees which obviously have greater or less taper than these average figures allow for, and the observer's judgment must guide him in deducting for the taper.

The merchantable lengths of especially valuable timber should be measured, if possible, with some instrument designed for this purpose, or at least by holding a 12 or 16-foot pole against the tree. The lengths of select logs are most important to determine accurately, and these are usually limited to the lower part of the tree which can be measured with a pole.

Since defects of different kinds often cut down the scale very materially, the observer should keep special notes of all observable injuries, malformations, or signs of rot likely to influence the amount and quality of the product.

The volume table method of estimating requires only a record of the diameter breast-high of each tree, and either the number of 16-foot logs it contains or its total height. From these data the volumes can be obtained from the appropriate volume table (Tables 8-11). When it is desired to estimate the more valuable trees in log lengths and the less valuable as entire trees, the record for both can be made on the same sheet, as illustrated in Table 12. To assist the eye in estimating total heights and log lengths, the measurement of a few felled trees will be helpful.

Sizing up every tree in the woodlot or at least each of the more valuable ones will as a rule give closer results than basing the estimate of the whole tract on one or more carefully estimated sample areas. The work does not have to be done all at once; and by marking the point where he is compelled to stop, the farmer may do only part of the estimating at a time, and thus cover his entire woodlot without neglecting other duties. Where it is necessary to employ the sample plot method, the area of all the plots together should be as large as possible; and though the plots themselves may be small, they should be scattered through the woodlot so as to

represent as closely as possible average conditions. A convenient size for a single plot is one-quarter acre (roughly a square measuring 104x104 feet, a strip 52x209 feet, or a circle 20 paces—59 feet—in radius). The yield on the sample plots should be totalled for each of the kinds and classes of material, the average amount per acre of each kind determined, and this amount multiplied by the total number of acres in the woodlot.

IV. KNOWLEDGE OF MARKETS.

The woodlot owner must secure detailed information on markets in order to sell most profitably. Examination of local markets should come first, and should be the most detailed, as a large proportion of woodlot products can only be shipped outside the local market in manufactured, or partially manufactured form. Investigation should then be extended in increasing circles to outside markets for more valuable products, such as high grade logs or specially sawed or rived stock, which can often be shipped long distances and sold at a greater profit than if disposed of near by. Local markets, where the net profits may be the same, are preferable to outside markets because of the closer relationship possible between buyer and seller. They also offer, as a rule, a much wider range of utilization and require a less degree of manufacture.

The following kinds of markets should be investigated:

1. *High Grade Logs*—Large saw and veneer mills, local or at a distance.
2. *Common and Cull Logs*—Chiefly local saw mills and slack cooperage plants.
3. *Ties*—Nearby railroads and local and outside dealers.
4. *Poles*—Local and outside dealers and telephone and telegraph companies.
5. *Piling*—Railroads, dock companies and dealers in large cities.
6. *Posts*—Local market, and dealers in large cities.
7. *Bolts* (for vehicle stock, handles, cooperage, shuttles)—Nearby factories, or points within a very cheap railroad haul.

8. *Sawed or Rived Stock* (for vehicles, handles, cooperage and shuttles)—Wide range of factories, local or distant.

9. *Lumber*—Local market, and dealers and wood-using plants, especially planing mills, in large towns and cities. Much the larger part of the lumber cut from woodlots will be of low grade, which it will not pay to try to sell at any great distance on account of freight charges.

10. *Cordwood*—Consumers, local dealers, or dealers within a very cheap railroad haul.

11. *Tanbark*—Local dealers, local or distant tanneries.

12. *Mining Timbers*—Local mines only, as the mines are located in regions of abundant local supply of forest products.

The chief market possibilities of the different species of trees are indicated on pages 124 to 140, under "Wood-using Industries" and "The Native Woodlot Trees and Their Uses." Reference to these topics will assist the prospective seller in narrowing down the field of his investigations, and in avoiding useless correspondence. On pages 124 to 140 of this bulletin are given the names of a large number of wood-using plants and dealers in forest products. From this list the woodlot owner can select those which appear likely to be in the market for the particular classes of products he has for sale, and which do not appear to be at a prohibitive distance. In writing to these, state as clearly and briefly as possible the kind and amount of products for sale, and ask that prices and specifications be sent in case the firm is in the market for the products mentioned. It is well to ask also for the favor of any information regarding other possible markets in case the addressee cannot purchase the products that are for sale.

V. COSTS AND PROFITS.

There are often a variety of ways of marketing each kind and size of tree in the woodlot. The choice depends not only upon the prices offered, but also upon the cost of getting the material out in the required form. The real basis on which decisions should be made is the net or stumpage value of the product. This is obtained by

subtracting the total (estimated) cost of production, including haul to the point of delivery, from the price anticipated. When the timber is sold on the stump, this computation is of course unnecessary. Otherwise it may include the costs of felling, cutting up, peeling, splitting or riving, stacking, swamping and skidding, hauling, loading, sawing and handling lumber, and freight. On pages 112 to 113 are listed the approximate costs of these operations, for different kinds of products.

The following example illustrates the use of these figures in computing the possible net profits (or stumpage values) which could be obtained from the same material if sold for different uses. A farmer living 8 miles from a railroad wishes to sell some "common" oak timber. The distance and roads are such as to permit of but one round trip haul per day for one team. He finds two possible purchasers; one, a dealer in a nearby town who offers \$20 per 1,000 board feet, delivered, of oak dimension lumber; the other, a local mill at a distance permitting one haul per day which offers \$10 per 1,000 board feet, log scale, delivered, for the common run of oak saw logs. To produce the dimension lumber he could have a portable mill set up in his timber so that the cost of hauling the logs to the mill would be avoided; and he would estimate his costs of cutting and skidding the logs and manufacturing, handling, hauling, and loading the lumber as being equal to those given as average on page 112. In addition, there would be the item of railroad shipment at, say, 10 cents per 100 pounds, or \$4 per 1,000 board feet. If he sold to the saw mill, his costs would include cutting and hauling (say 600 board feet of logs per load) and no skidding. In addition, there would be a mill-over-run* amounting to 33 per cent, which would make the price offered for the logs, by lumber scale, \$7.50 per 1,000 board feet, as the mill operator would get 1,333 board feet of lumber for his \$10.

The net or stumpage value for the timber in the two cases would be figured as follows:

*Due to the fact that the lumber sawed out of a sound log always exceeds the amount which the ordinary log scale designates as the contents of a log of its diameter and length.

(1) Timber Sold for Lumber at \$20 per 1,000 Board Feet.

Cutting and skidding to sawmill:	
Log scale	\$ 4.25
Lumber scale	3.19
Manufacture, handling, hauling, loading.....	8.50
Freight	4.00
Total cost of production	16.75
Net or stumpage value.....	4.31

(2) Timber Sold as Saw Logs at \$10 per 1,000 Feet, Log Scale:

Cutting and hauling logs, per 1,000 bd. ft.:	
Log scale	\$6.25
Lumber scale	4.67
Net profit or stumpage value per 1,000 bd. ft., log scale....	3.75
Net profit or stumpage value per 1,000 bd. ft., lumber scale	2.83

In the above case the farmer would get more for his stumpage by selling sawed lumber.

The costs of getting out woodlot products in different ways are approximately as follows:

Cost of Logging (Hardwoods).

	Cost per 1,000 bd. ft.		
	Low	High	Ave.
Felling and cutting into logs.....	\$.75	\$ 1.75	\$ 1.25
Skidding (often omitted or included with hauling expenses) (including swamping..)	2.00	4.00	3.00
Hauling, 1 trip a day [†] :			
1,000 feet per load.....	2.00	4.00	3.00
800 feet per load.....	2.50	5.00	3.00
600 feet per load.....	3.33	6.67	5.00
400 feet per load.....	5.00	10.00	7.50
200 feet per load.....	10.00	20.00	15.00
Loading		1.00	.50

Manufacture and Handling of Lumber.

	Cost per 1,000 bd. ft.		
	Low	High	Ave.
Sawing and sticking.....	\$ 3.00	\$ 4.00	\$ 3.50
Planing and finishing.....	1.00	2.00	1.50
Handling lumber in yard (including grading and loading)	1.00	1.00	1.00
Hauling, 1 trip a day [†] :			
(1,000 board feet per load)	2.00	4.00	3.00
Loading on cars .....	.50	1.50	1.00

Cost of Tie Production.
(For 7 x 9 tie; 6 x 8 tie one-fifth less.)

	Cost per tie		
	Low	High	Ave.
Cutting and hewing ties.....	\$.12	\$.18	\$.15
Cutting and sawing ties by portable mill.....	.15	.20	.18
Hauling, 1 trip a day*:			
10 ties .....	.20	.40	.30
15 ties .....	.15	.30	.23
20 ties .....	.10	.20	.15
Loading on cars .....	.03	.05	.04

Cost of Pole and Pile Production.
(35-foot length, 6 inches top.)

	Cost per pole or pile		
	Low	High	Ave.
Cutting and trimming	\$.20	\$.40	\$.30
Hauling, 1 trip a day [†] :			
3 poles per load.....	.66	1.33	1.00
4 poles per load.....	.50	1.00	.75
5 poles per load.....	.40	.80	.60
Loading on cars .....	.05	.15	.10

*For more than one trip a day divide these amounts by the number of trips per day. For less than one trip a day multiply these amounts by the number of days per trip.

†For more than one trip divide these amounts by the number of trips.

Cost of Producing Material per Cord and per Rick Firewood.

	Cost per cord		
	Low	High	Avg.
Cutting (per stacked cord of 4-foot wood).....	\$.75	\$ 1.25	\$ 1.00
Hauling, 1 trip a day.....	2.00	4.00	3.00

**Handle Bolts.
(Hickory.)**

	Cost per rick		
	Low	High	Avg.
Cutting	\$ 1.00	\$ 1.50	\$ 1.25
Hauling, 1 trip a day.....	2.00	4.00	3.00

Slack Cooperage, Veneer and Excelsior Bolts.

	Cost per rick (sticks 30 inches long)		
	Low	High	Avg.
Cutting	\$.50	\$ 1.00	\$.75
Hauling, 1 trip a day.....	1.50	3.50	2.50

**Pulpwood (peeled).
(Poplar, Basswood, Gum.)**

	Cost per rick (sticks 5 feet long)		
	Low	High	Avg.
Felling, peeling and stacking.....	\$ 1.25	\$ 1.75	\$ 1.50
Hauling, 1 trip a day.....	2.00	4.00	3.00

Extract Wood.

	Cost per rick (160 cu. feet)		
	Low	High	Avg.
Cutting and splitting	\$ 1.00	\$ 1.50	\$ 1.25
Hauling, 1 trip a day.....	2.50	4.50	3.50

Extract or Tan Bark.

	Cost per cord of 2,240 lbs., dry
Cutting, peeling and curing.....	\$1.25 to \$1.50
Loading .....	.50 to .50
Hauling, 1 trip haul.....	2.00 to 3.00

Freight. Tables 13, 14, 15 and 16 should prove useful in calculating the costs of shipping different kinds of wood and classes of material.

TABLE 13. COST PER 1,000 BOARD FEET OF SHIPPING DIFFERENT KINDS OF SEASONED LUMBER AT THE FREIGHT RATES GIVEN IN THE TABLE.

Kinds of Wood	Thickness of Lumber	Weight per 1,000 bd. ft.	Freight Rate in Cents per 100 Pounds*									
			1	2	3	4	5	6	7	8	9	10
			Cost per 1,000 Board Feet at Above Rates									
Hickory	1 inch and up	5,000	\$0.50	\$1.00	\$1.50	\$2.00	\$2.50	\$3.00	\$3.50	\$4.00	\$4.50	\$5.00
Oak, beech, maple, walnut	1 inch and up	4,000	.40	.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00
Oak (quarter sawed)	1 inch	3,200	.32	.64	.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20
Oak (quarter sawed)	1 inch	2,700	.27	.54	.81	1.08	1.35	1.62	1.89	2.16	2.43	2.70
Oak (quarter sawed)	1 inch	2,200	.22	.44	.66	.88	1.10	1.32	1.54	1.76	1.98	2.20
Oak (quarter sawed)	1 inch	2,000	.20	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00
Aspen and rock elm	1 inch and up	3,800	.38	.76	1.14	1.52	1.90	2.28	2.66	3.04	3.42	3.80
Soft elm and sycamore	1 inch and up	3,200	.32	.64	.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20
Shortleaf pine	boards	3,200	.32	.64	.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20
Cypress	boards	3,000	.30	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00
Red gum	1 inch and up	3,300	.33	.66	.99	1.32	1.65	1.98	2.31	2.64	2.97	3.30
Red gum	1 inch	2,500	.25	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Red gum	1 inch	2,200	.22	.44	.66	.88	1.10	1.32	1.54	1.76	1.98	2.20
Red gum	1 inch	1,700	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.53	1.70
Sap gum	1 inch and up	1,300	.13	.26	.39	.52	.65	.78	.91	1.04	1.17	1.30
Sap gum	1 inch	3,100	.31	.62	.93	1.24	1.55	1.86	2.17	2.48	2.79	3.10
Sap gum	1 inch	2,400	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.40
Sap gum	1 inch	2,000	.20	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00
Sap gum	1 inch	1,600	.16	.32	.48	.64	.80	.96	1.12	1.28	1.44	1.60
Sap gum	1 inch	1,250	.12	.25	.38	.50	.62	.75	.88	1.00	1.12	1.25
Tupelo	1 inch	3,000	.30	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00
Tupelo	2 inches and up	3,200	.32	.64	.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20
Poplar, chestnut, cherry and cottonwood	1 inch and up	2,800	.28	.56	.84	1.12	1.40	1.68	1.96	2.24	2.52	2.80
Poplar	1 inch	2,100	.21	.42	.63	.84	1.05	1.26	1.47	1.68	1.89	2.10
Poplar	1 inch	1,600	.16	.32	.48	.64	.80	.96	1.12	1.28	1.44	1.60
Basswood	1 inch and up	2,600	.26	.52	.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60
Buckeye	1 inch and up	2,500	.25	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50

*For rates over 10 cents per 100, either use multiples of those given for 1 to 10 cents, or add 2 or more of them together.

Table 14. Cost per 1,000 board feet, Doyle rule, of shipping green logs of different kinds of woods at the freight rates given in table.

Kinds of Wood	Size of Logs Diameter Inside Bark at Small End Inches	Weight per 1,000 bd. ft. Doyle Scale	Freight rate in cents per 100 pounds.*									
			Cost per 1,000 board feet, Doyle scale, at above rates.									
			1	2	3	4	5	6	7	8	9	10
Ash	12	11,100	\$1.11	\$2.22	\$3.33	\$4.44	\$5.55	\$6.66	\$ 7.77	\$ 8.88	\$ 9.99	\$11.10
	18	7,700	.77	1.54	2.31	3.08	3.85	4.62	5.39	6.16	6.93	7.70
	24	6,600	.66	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60
Basswood	12	9,500	.95	1.90	2.85	3.80	4.75	5.70	6.65	7.60	8.55	9.50
	18	6,600	.66	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60
	24	5,600	.56	1.12	1.68	2.24	2.80	3.36	3.92	4.48	5.04	5.60
Beech	12	12,700	1.27	2.54	3.81	5.08	6.35	7.62	8.89	10.16	11.43	12.70
	18	8,900	.89	1.78	2.67	3.56	4.45	5.34	6.23	7.12	8.01	8.90
	24	7,500	.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
Cherry	12	10,500	1.05	2.10	3.15	4.20	5.25	6.30	7.35	8.40	9.45	10.50
	18	7,300	.73	1.46	2.19	2.92	3.65	4.38	5.11	5.84	6.57	7.30
	24	6,200	.62	1.24	1.86	2.48	3.10	3.72	4.34	4.96	5.58	6.20
Chestnut	12	12,600	1.26	2.52	3.78	5.04	6.30	7.56	8.82	10.08	11.34	12.60
	18	8,800	.88	1.76	2.64	3.52	4.40	5.28	6.16	7.04	7.92	8.80
	24	7,500	.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
Elm, soft	12	11,200	1.12	2.24	3.36	4.48	5.60	6.72	7.84	8.96	10.08	11.20
	18	7,800	.86	1.32	1.98	2.64	3.30	4.68	5.46	6.24	7.02	7.80
	24	6,600	.66	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60

Kinds of Wood	Size of Logs Diameter Inside Bark at Small End Inches	Weight per 1,000 lb. of Doyle Scale	Freight rate in cents per 100 pounds.*									
			1	2	3	4	5	6	7	8	9	10
			Cost per 1,000 board feet, Doyle scale, at above rates.									
Gum, red	12	10,700	\$ 1.07	\$2.14	\$3.21	\$4.28	\$5.35	\$6.42	\$7.49	\$8.56	\$9.63	\$10.70
	18	7,500	.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
	24	6,300	.63	1.26	1.89	2.52	3.15	3.78	4.41	5.04	5.67	6.30
Hickory	12	14,700	1.47	2.94	4.41	5.88	7.35	8.82	10.29	11.76	13.23	14.70
	18	10,300	1.03	2.06	3.09	4.12	5.15	6.18	7.21	8.24	9.27	10.30
	24	8,700	.87	1.74	2.61	3.48	4.35	5.22	6.09	6.96	7.83	8.70
Maple, sugar.....	12	12,900	1.29	2.58	3.87	5.16	6.45	7.74	9.03	10.32	11.61	12.90
	18	9,000	.90	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10	9.00
	24	7,600	.76	1.52	2.28	3.04	3.80	4.56	5.32	6.08	6.84	7.60
Maple, red.....	12	11,900	1.19	2.38	3.57	4.76	5.95	7.14	8.33	9.52	10.71	11.90
	18	8,300	.83	1.66	2.49	3.32	4.15	4.98	5.81	6.64	7.47	8.30
	24	7,100	.71	1.42	2.13	2.84	3.55	4.26	4.97	5.68	6.39	7.10
Oak, red.....	12	14,800	1.48	2.96	4.44	5.92	7.40	8.88	10.36	11.84	13.32	14.80
	18	10,300	1.03	2.06	3.09	4.12	5.15	6.18	7.21	8.24	9.27	10.30
	24	8,800	.88	1.76	2.64	3.52	4.40	5.28	6.16	7.04	7.92	8.80
Oak, white.....	12	14,400	1.44	2.88	4.32	5.76	7.20	8.64	10.08	11.52	12.96	14.40
	18	10,000	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
	24	8,500	.85	1.70	2.55	3.40	4.25	5.10	5.95	6.80	7.65	8.50

Sycamore	12	12,000	1.20	2.40	3.60	4.80	6.00	7.20	8.40	9.60	10.80	12.00
	18	8,400	.84	1.68	2.52	3.36	4.20	5.04	5.88	6.72	7.56	8.40
	24	7,100	.71	1.42	2.13	2.84	3.55	4.26	4.97	5.68	6.39	7.10
Yellow poplar	12	8,800	.88	1.76	2.64	3.52	4.40	5.28	6.16	7.04	7.92	8.80
	18	6,100	.61	1.22	1.83	2.44	3.05	3.66	4.27	4.88	5.49	6.10
	24	5,200	.52	1.04	1.56	2.08	2.60	3.12	3.64	4.16	4.68	5.20
Walnut	12	11,900	1.19	2.38	3.57	4.76	5.95	7.14	8.33	9.52	10.71	11.90
	18	8,300	.83	1.66	2.49	3.32	4.15	4.98	5.81	6.64	7.47	8.30
	24	7,100	.71	1.42	2.13	2.84	3.55	4.26	4.97	5.68	6.39	7.10

*For rates over 10 cents per 100, either use multiples of those for 1 to 10 cents, or add 2 or more of them together.

Table 15. Shipping weights per stack* of bolts, green and dry, of different lengths and diameters and different kinds of wood.

Species	Diameter Inches	Length of Bolt—Feet						Weight Per Cu. Ft. Pounds
		2½ (¾ cd.)	3 (¾ cd.)	3½ (¾ cd.)	4 (1 cord)	4½ (1½ cd.)	5 (1½ cd.)	
		6 (1½ cd.)	6 (1½ cd.)	6 (1½ cd.)	6 (1½ cd.)	6 (1½ cd.)	6 (1½ cd.)	
Weight per Stack—Pounds								
Ash, white Green	6	2,600	3,200	3,700	4,200	4,800	5,300	48.1
	9	2,800	3,300	3,900	4,400	5,000	5,500	6,300
	12	2,900	3,400	4,000	4,600	5,100	5,600	6,600
Air dry	6	2,300	2,800	3,200	3,700	4,200	4,600	42.1
	9	2,400	2,900	3,400	3,900	4,400	4,800	5,600
	12	2,500	3,000	3,500	4,000	4,500	5,000	6,000
Basswood Green	6	2,300	2,700	3,200	3,600	4,100	4,500	41.3
	9	2,400	2,800	3,300	3,800	4,300	4,700	5,500
	12	2,500	2,900	3,400	3,900	4,400	4,900	5,900
Air dry	6	1,400	1,700	2,000	2,300	2,600	2,800	25.8
	9	1,500	1,800	2,100	2,400	2,700	3,000	3,400
	12	1,500	1,800	2,100	2,500	2,800	3,100	3,700
Cottonwood Green	6	2,600	3,100	3,600	4,100	4,600	5,100	46.5
	9	2,700	3,200	3,700	4,300	4,800	5,300	6,100
	12	2,800	3,300	3,900	4,400	5,000	5,500	6,400
Air dry	6	1,500	1,800	2,100	2,400	2,700	3,000	27.3
	9	1,600	1,900	2,200	2,500	2,800	3,100	3,600
	12	1,600	1,900	2,300	2,600	2,900	3,200	3,900
Elm, rock and white Green	6	2,700	3,200	3,700	4,300	4,800	5,300	48.6
	9	2,800	3,400	3,900	4,500	5,000	5,500	6,400
	12	2,900	3,500	4,000	4,600	5,200	5,800	6,700
Air dry	6	1,900	2,300	2,700	3,000	3,400	3,800	34.6
	9	2,000	2,400	2,800	3,200	3,600	4,000	4,900
	12	2,100	2,500	2,900	3,300	3,700	4,100	4,900
Hickory, shagbark Green	6	3,500	4,200	4,900	5,600	6,300	7,000	63.8
	9	3,700	4,400	5,100	5,900	6,600	7,300	8,400
	12	3,800	4,500	5,300	6,100	6,800	7,600	8,800
Air dry	6	2,800	3,400	4,000	4,500	5,100	5,700	6,800
	9	3,000	3,600	4,100	4,700	5,300	5,900	7,100
	12	3,100	3,700	4,300	4,900	5,500	6,100	7,300

*Stacks are 4 feet in height by 8 feet long, made up of bolts of different sizes.

Bolts 4 feet long make a standard cord, while shorter lengths make "short cords," and longer lengths a cord and over.

Table 16. Weights of piling of different* sizes, green and dry, for different kinds of wood; also weight per cubic foot of each.

Weight—Pounds													
Length	White Oak		Black Oak		Sugar Maple		Chestnut		White Elm		Black Gum		Increase for Top Diameter of 8 ins. Per cent.
	Green	Air Dry	Green	Air Dry	Green	Air Dry	Green	Air Dry	Green	Air Dry	Green	Air Dry	
20	610	470	610	440	550	430	540	300	480	340	440	350	15.3
25	770	590	770	550	690	530	670	370	600	430	550	450	15.4
30	920	700	920	660	820	640	810	440	710	510	660	530	15.6
35	1,080	820	1,080	770	960	750	940	520	840	600	770	620	15.7
40	1,580	1,200	1,590	1,140	1,410	1,100	1,390	760	1,230	880	1,130	920	12.3
45	1,780	1,360	1,790	1,280	1,590	1,240	1,560	860	1,390	990	1,270	1,030	11.9
50	1,980	1,500	1,980	1,420	1,770	1,370	1,730	950	1,540	1,090	1,410	1,140	12.3
Weights per cubic foot used above—pounds.													
	62.7	45.0	62.5	47.6	55.9	43.4	54.8	30.2	48.6	34.6	44.7	36.2	

*Top diameter 6 inches. Butt diameter 12 inches for piling from 20 to 35 feet long, inclusive; 14 inches for piling 40 to 50 feet, inclusive.

Freight—Tables 13, 14, 15 and 16 should prove useful in calculating the costs of shipping different kinds of wood and classes of material.

VI. CONTRACTS AND SUPERVISION.

In disposing of timber it is always best to have written contracts with purchasers, or with the jobbers who are to deliver the material to purchasers. It is best, of course, to eliminate the jobber, if possible, and to deliver the material directly to the purchaser.

The following are the important items to be included in a contract with a purchaser where the products are to be cut and delivered by the farmer.

1. Kinds of woods and classes of materials, such as logs, bolts, poles, lumber, etc., and specifications in regard to forms, sizes, quality or grade, and quantity of different materials.
2. Price per unit of measurement, such as per 1,000 feet log scale or per cord, for each specified class of material, and time when payment is to be made. Payment should be made on delivery unless seller is protected by a bond on the purchaser.
3. Method of sale or delivery of the material.
4. Times, places and methods of measurements of the material, including log rules, methods of allowing for defects, grading rules, etc., to be used.
5. Bond or other guarantee for faithful performance of contract.
6. Method of arbitration in case of disputes.

In case sale is to be made of standing timber the following* additional stipulations should be provided for in the contract. Many of these same stipulations can be used with jobbers in case contracts are made with them to cut and deliver products to purchaser.

1. Timber to be cut.
Quantity and location of cutting.
Sizes of trees to be cut or saved.
Kinds of trees to be cut or saved.
Provisions should be made for exceptions to the above clauses through marking of special trees to be saved or cut. If possible, it is best to allow only those trees to be cut which are marked.
2. Provisions against waste.
Height of stumps. This height should be specified, and ordinarily it should not exceed the stump's diameter.

*From Bulletin 9 of the State of New York Conservation Commission.

Utilization of tops. The smallest diameter to which material must be utilized should be stated. Material to be taken. It should be specified that all merchantable material be taken, and the specific amount of defects which products may have and still be considered merchantable should be stated.

Form in which timber is to be worked up. This should be specified if possible (thus, that certain sizes be converted to logs, others to poles, etc.).

Materials to be used for roads, skidways and other lumbering operations. It should be specified that only dead trees or certain inferior kinds be used.

3. Protection against damage.

Care against injuring trees to be left.

Provision for protection from fire, and responsibility for fires occurring while on the work.

Any fences removed, etc., to be replaced by substantial new fences.

4. Location of camps, and mill site, etc.

If these are used, provisions concerning them should be made.

5. Payments.

Time—Generally at least half should be paid as soon as trees are cut; and the rest before removal from land.

Price per unit of measurement for each grade of material specified.

6. Faithful performance.

Bond or other guarantee of at least one-quarter of the value of products included should be required. Penalties for violations of different clauses should be stipulated; in case of cutting trees to be left or failing to remove trees marked for cutting, at double the ordinary price agreed on; for carelessly injuring trees to be left or other violations, a definite sum for each offense.

7. Duration of contract.

The contract should stipulate when work is to begin and end, and that certain amount is to be done within given limits of time. Repeated violations of any terms of the contract shall terminate it, with forfeiture of bond for faithful performance.

Supervision of cutting, logging, and scaling operations is very important, and a definite and clear contract, in writing, greatly simplifies this work. Measurements of material purchased should always be checked as provided for in the contract.

VII. CO-OPERATION.

The chances of increasing profits from the sale of woodlot products can be greatly improved by intelligent co-operation with neighbors. The Forest Service (U. S. Department of Agriculture), (in conjunction with various State organizations) plans to assist in developing this feature. Its agent will work co-operatively with the county agent and farmers in a given county to decide upon ways and means for profitable woodlot utilization in the county.

There are many different ways in which co-operation may be effected, only a few of which are suggested here:

1. Where favorable contracts for the sale of woodlot material can be made only in carload lots and the individual farmer has not enough material to fill such contracts by himself, it will be wise for him to co-operate with his neighbors in supplying the necessary amounts.

2. Co-operation will be useful in securing information on favorable markets and prices for different classes of material.

3. Co-operative logging and manufacture of different classes of material, including the collective ownership and operation of logging outfits, saw mills, etc., may yield higher returns to the farmers than the present methods of sale.

Only by intelligent co-operation along some such lines will the woodlot owners, as a class, be able to get better values for the different classes of material grown in their woodlots.

SUMMARY OF SUGGESTIONS ON MARKETING.

What the farmer should do in order to get the best returns from his woodlot sales may be summed up as follows:

1. Estimate the timber in the woodlot in terms of the most profitable classes of materials.

2. Get as complete a knowledge as possible of local and outside markets for the different kinds of wood and classes of material contained in the woodlot. This should include the current prices and the specifications in re-

gard to quality, size, and form of materials. Write freely to wood-using firms for prices and specifications, using the directory of firms given in this report.

3. Estimate the cost of getting out the different kinds of trees and classes of materials for the different possible markets; figure which markets would yield the highest net profits, and sell accordingly.

4. Never sell by the boundary or lump sum unless the timber has been carefully estimated.

5. Where there is uncertainty in regard to the amount of standing timber of a given kind in the woodlot, sell by log scale, cord, rick, or piece.

6. Always have a written contract with the purchaser, preferably supported by bond, stipulating in detail the form, size, and quality or grade of materials to be purchased by him, and the method of scaling, payments, etc.

7. Be thoroughly familiar with any deficiencies in the log rule to be used, especially in regard to underscaling of small logs, and figure on the price accordingly.

8. Co-operate freely with other woodlot owners in securing advantageous markets, and, if practicable, in logging and manufacture.

9. Be careful to use as much of every tree cut as can possibly be taken out at a profit.

10. Do not cut small thrifty trees less than a foot or so in diameter on land to be held in woodlot, unless they are crowding more desirable individuals that are to be left.

HOW TO PREVENT THE DETERIORATION OF CUT WOODLOT PRODUCTS.

It is often necessary or desirable to put off the delivery of logs, bolts, poles, etc., until some months after cutting, either in order to allow them to season or because a good sale cannot be arranged at once. A great deal of the weight of fresh-cut products is due to the water they contain, and a few months' seasoning will often reduce this to a marked degree, the amount of reduction depending, of course, on the climate, the weather, and the exposure to sun and air. At the same time, unless preventive measures be taken, the products are sure

to deteriorate through decay, insect attack, checking, or some other agency. A certain amount of deterioration is apt to take place in any case if the delivery is put off for some time; but the amount can be greatly reduced, and the saving in weight and increase in strength due to seasoning is more than enough to counterbalance any small deterioration which may occur in spite of the preventive measures.

Logs should never be allowed to remain long in the woods after cutting. As soon as possible they should be taken to a dry, well-aired, and unshaded area, and placed on skids well off the ground. The bark may be left on the logs and the ends should be coated with paint, creosote, or tar. This will not only assist in preventing decay but will also retard seasoning to some extent and thus keep the logs from checking badly.

Poles should be peeled and hauled or dragged to a place free from debris or rank vegetation and freely exposed to sun and wind. There they should be rolled upon skidways not less than 18 inches high, so that no part of them will rest on the ground. There should be only one layer of poles on each skidway. When ties are cut it is usually cheapest and most desirable to haul them, unseasoned, directly to the railroad and there pile them according to the specifications furnished by the tie buyer.

Cordwood should be stacked in loose piles in a sunny well-aired and well-drained place free from rank vegetation. Two sticks on the ground running the length of the pile will keep it from contact with the soil and thus prevent decay in the lower layers.

A DIRECTORY OF WOOD-USING FIRMS WHICH FURNISH POSSIBLE MARKETS FOR KENTUCKY WOODLOT PRODUCTS.

1. Sawmills.
2. Vehicle stock plants and dealers.
3. Tie, pole and pile buyers.
4. Veneer mills.
5. Slack cooperage plants.
6. Pulp and excelsior plants.
7. Tanbark and extract wood plants and users.

8. Handle factories.
9. Miscellaneous users of logs and bolts.
10. Users of cedar.
11. Buyers of black walnut logs.
12. Tight cooperage plants and dealers.
13. Wood-using firms using sawed lumber.

1. SAW MILLS IN KENTUCKY USING SAW LOGS.

(Mills which cut, for the most part, 1,000,000 board feet or more.)

Name.	County	Post Office
Smith & Stevenson.....	Adair.....	Columbia
E. M. Ausbrooks.....	Allen.....	Scottsville
Wolford Bros.....	Adair.....	Casey Creek
A. F. Scott.....	Adair.....	Casey Creek
Braswell Tie & Lbr. Co.....	Allen.....	Scottsville
Thompson, Wade & Co.....	Allen.....	Scottsville
T. W. Girard.....	Ballard.....	Barlow & Bland- ville
New Gleason P'l'g. Mill.....	Barren.....	Glasgow
J. H. Bybee.....	Barren.....	Lecta
Rose Run Lbr. Co.....	Bath.....	Olympia
Salt Lick Lumber Co.....	Bath.....	Salt Lick
Silas M. Slushy.....	Bell.....	Slusher
T. J. Asher & Sons.....	Bell.....	Wasioto
Ashland Lumber Co.....	Boyd.....	Ashland
W. R. Vansant Lbr. Co.....	Boyd.....	Ashland
H. J. Ross.....	Boyd.....	Rush
Vansant, Kitchen & Co.....	Boyd.....	Ashland
Dimension Lbr. Co.....	Boyd.....	Catlettsburg
Wright, Hitchen Lbr. Co.....	Boyd.....	Catlettsburg
T. J. Gilliam.....	Boyd.....	Rice
H. C. Kyler.....	Breckinridge.....	Ammons
Oscar Combs.....	Breathitt.....	Canal
Reliance Mfg. Co.....	Breathitt.....	Jackson
Swann, Day Lbr. Co.....	Breathitt.....	Jackson
Mowbray & Robinson.....	Breathitt.....	Quicksand
J. P. Johnson Co.....	Breathitt.....	Lexington, Ky.
A. M. Bays.....	Breathitt.....	Bays
Busskirk-Rutledge Lbr. Co.....	Breathitt.....	Quicksand
D. B. Cartwright & Bro.....	Butler.....	Townsville
Scudder Galloway.....	Calloway.....	Murray
Ed Hicks.....	Calloway.....	Murray
B. F. Schroeder.....	Calloway.....	Murray
Lassiter Bros. Co.....	Calloway.....	New Concord

Name	County	Post Office
J. C. Ford.....	Carlisle.....	Arlington & Burkley
Arlington Lbr. Co.....	Carlisle.....	Arlington
J. W. Turk Lbr. Co.....	Carlisle.....	Bardwell
Adkinson Bros. Co.....	Carroll.....	Carrollton
Eastern Ky. Lbr. Co.....	Carter.....	Anglin
R. M. Lyttle.....	Carter.....	Whitt
Arden & Fraley.....	Carter.....	Stinson (and Willard)
Wolford Bros.....	Casey.....	Casey Creek
A. E. Chandler.....	Casey.....	Clements ville
Forbes Mfg. Co.....	Christian.....	Hopkinsville
C. A. Ogden.....	Christian.....	Hopkinsville
Terry & Cranor.....	Christian.....	Crofton
W. T. Gates.....	Christian.....	Fruithill
J. M. Wells.....	Christian.....	Johnsons
W. L. Smith & Son.....	Clinton.....	Albany
Lowry & Crider.....	Crittenden.....	Weston
J. S. Cottrell & Co.....	Daviess.....	Owensboro
C. E. Dawson & Son.....	Daviess.....	Owensboro
Stimson & Co.....	Daviess.....	Owensboro
J. K. Stone & Bro.....	Daviess.....	Owensboro
Vincent & Son.....	Edmonson.....	Brownsville
H. C. Huff.....	Edmonson.....	Chalybeate
Franklin & Turner.....	Elliott.....	Loveland
Mowbray & Robinson.....	Estill.....	West Irvine
E. R. Spotswood & Son.....	Fayette.....	Lexington
Ky. Lbr. Co.....	Fayette.....	Lexington
W. H. Muse & Bros.....	Fleming.....	Enterprise
Stewart & Salisbury.....	Floyd.....	Dwale
Beaver Lumber Co.....	Floyd.....	Langley
J. J. Boling.....	Floyd.....	Woods
Charles Brainard.....	Floyd.....	Linwood
Conley & Collins.....	Floyd.....	Lackey
Kinney Bros.....	Franklin.....	Frankfort
Eversole Lbr. Co.....	Franklin.....	Frankfort
Mengel Box Co.....	Fulton.....	Hickman
Pickard Bros.....	Graves.....	Lynnville
Watkins & Downs.....	Grayson.....	Clarkson
Green Bros.....	Grayson.....	Falls of Rough
J. A. Copp & Co.....	Hardin.....	Pine Grove
Cumberland Lumber Co.....	Harlan.....	Harlan
Dione Lbr. Co.....	Harlan.....	Dione
Lane Lbr. & Milling Co.....	Hart.....	Mumfordsville
Wyman & Gile.....	Hart.....	Monroe
H. W. McCandless.....	Hart.....	Cub Run

Name	County	Post Office
W. H. Stephen.....	Henderson.....	Henderson
J. T. Cochran & Sons.....	Hickman.....	Oakton
J. E. Lucas.....	Hickman.....	Mayfield
U. H. Felker.....	Hopkins.....	Dalton
J. W. Lewis.....	Hopkins.....	Dawson Springs
P. L. Neisy.....	Hopkins.....	Kirkwood Springs
Anderson Veneer & Sawmill Co.....	Jefferson.....	Louisville
C. C. Mengel & Bro. Co.....	Jefferson.....	Louisville
Louisville Point Lbr. Co.....	Jefferson.....	Louisville
Edw. L. Davis Lbr Co.....	Jefferson.....	Louisville
North Vernon Lbr. Co.....	Jefferson.....	Louisville
Wood Mosaic Co.....	Jefferson.....	Highland Park
W. L. Conly.....	Johnson.....	Hagerhill
Rockcastle Lbr. Co.....	Johnson.....	Offutt
Allen Bros.....	Johnson.....	Lowmansville
Carter Coal Co.....	Knox.....	Warren
Rathfon Scent Co.....	Knox.....	Barbourville
C. J. Vaughn.....	Larue.....	Magnolia
W. H. Lyons.....	Larue.....	Lyons
Edelen Bros.....	Larue.....	Gleanings
J. C. McKee.....	Laurel.....	London
Thos. Nantz.....	Laurel.....	Bernstadt
D. C. Edwards.....	Laurel.....	London
Collinsworth & Ramey.....	Lawrence.....	Fallsburg
J. H. Livers.....	Larue.....	Hodgenville
C. D. & R. W. Hays.....	Larue.....	Hodgenville
Swann-Day Lbr. Co.....	Lee.....	Beattyville
Bell Point Lbr. Co.....	Lee.....	Belle Point
Price Congleton.....	Lee.....	Idamay
Forman-Earie Co.....	Lee.....	Heidelberg
John Mann.....	Lewis.....	Vanceburg
C. B. Gross.....	Leslie.....	Confluence
Kitchem Timber Co.....	Letcher.....	Mandrake
Consolidation Coal Co.....	Letcher.....	Jenkins & Mc- Roberts
Sherman Bentley.....	Letcher.....	Millstone
Blair & Blair.....	Letcher.....	Dongola
James Taylor.....	Letcher.....	Colson
London Mfg. Co.....	Laurel.....	London
P. M. Conder.....	Lincoln.....	Crab Orchard
F. Maxwell.....	Logan.....	Russellville
J. J. Penrod.....	Logan.....	Russellville
Snell & Thompson.....	Logan.....	Lewisburg
Nickell Bros.....	Lyon.....	Grand Rivers
Ferguson & Palmer Co.....	McCracken.....	Paducah
J. W. Little.....	McCracken.....	Paducah

Name	County	Post Office
Sherrill, King Mill Lbr. Co.....	McCracken.....	Paducah
Lucas Land & Lbr. Co.....	McCracken.....	Paducah
Langstaff & Orm Mfg. Co.....	McCracken.....	Paducah
R. A. Williams.....	McCreary.....	Oz
Green River Chain Co.....	McLean.....	Livermore
J. P. Daniel.....	McLean.....	Island
H. N. English.....	McLean.....	Livermore
Rickard Bros.....	McLean.....	Sacramento
Southern Lbr. & Broom Co.....	Madison.....	Valley View
James S. Conley.....	Magoffin.....	Lakeville
James D. Allen.....	Magoffin.....	Hendricks
Lee Congleton	Madison.....	Richmond
L. K. Venson.....	Madison.....	Pleasant
Harry Lancaster & Co.....	Marion.....	Lebanon
O. Brandon Lbr. Co.....	Marshall.....	Benton
Rockcastle Lbr. Co.....	Martin.....	Meek
Lebanon Lbr. Co.....	Marion.....	Lebanon
Phil Beasley	Mercer.....	Mayo
Lawrence Bros.....	Monroe.....	Tomkinsville
Oliver & Dickerson.....	Monroe.....	Tomkinsville
Walton Fannin	Morgan.....	Ezel
W. B. Mathews & Co.....	Mason.....	Maysville
John Meyerhofer	Muhlenberg.....	McNary
L. T. Wright.....	Ohio.....	Horton & Rosine
Chim Bros.....	Ohio.....	Beaver Dam
E. A. White.....	Ohio.....	Narrows
S. English	Owsley.....	Earnestville
Jas. Jayhart	Perry.....	Hazard
Richard Tackitt	Pike.....	Hartley & Myra
J. C. May.....	Pike.....	Sharondale
Justice Coleman Lbr. Co.....	Pike.....	Regina
York, Hatfield	Pike.....	McVeigh
Elkhorn Lbr. Co.....	Pike.....	Praise
Robert Dawson	Pike.....	Toler
W. D. Sutton.....	Pike.....	Wayland
Dana Lumber Co.....	Powell.....	Lombard
The Q. R. Longworth Co.....	Pulaski.....	Somerset
Kentucky Lbr. Co.....	Pulaski.....	Burnside
Ford Lbr. & Mfg. Co.....	Rockcastle.....	Winchester & Livingston
J. C. Rimell.....	Rockcastle.....	Wildie
Clearfield Lbr. Co.....	Rowan.....	Clearfield
B. F. Truertell.....	Rowan.....	Triplet
Whistler & Searcy.....	Rowan.....	Farmers
J. W. Voils.....	Russell.....	Russell Springs
Harris & Crowdus.....	Simpson.....	Franklin

Name	County	Post Office
T. T. Summers.....	Simpson.....	Franklin
Campbellsville Lbr. Co.....	Taylor.....	Campbellsville
M. Welborn	Todd.....	Clifty
J. T. O'Nan.....	Union.....	Morganfield
Bowling Green Lbr. Co.....	Warren.....	Bowling Green
Chas. Roemer	Warren.....	Bowling Green
J. H. Shearer & Co.....	Wayne.....	Monticello
Bassett Hdw. Mfg. Co.....	Wayne.....	Monticello
	(Hickory only)	
R. W. Justice.....	Warren.....	Woodburn (also at Greasy Creek & Mill Springs).
A. W. W. Lumber Co.....	Wayne.....	Parmleysville
Tenn. Hdw. & Lbr. Co.....	Wayne.....	Parmleysville
R. N. Hunter.....	Webster.....	Providence
Kentucky Lbr. Co.....	Whitley.....	Williamsburg
W. H. Phillippi.....	Whitley.....	Pine Knot
J. H. Harp.....	Whitley.....	Tidalwave
Kidd Bros.....	Whitley.....	Red Bird
F. E. West & Son.....	Whitley.....	Williamsburg
Robert Wells	Whitley.....	Spruceburg
Moon Lumber Co.....	Whitley.....	Williamsburg
Lovely and Clemons.....	Wolfe.....	Neola

Large Sawmills in Adjoining States.

Name	County	Post Office
John B. Ransom & Co.....		Nashville, Tenn.
Davidson, Hicks & Green Co.....		Nashville, Tenn.
Lieberman, Loveman & O'Brien.....		Nashville, Tenn.
Artman, Nicols & Cox Lbr. Co.....		Metropolis, Ill.
Young & Cutsinger.....		Evansville, Ind.
Maley & Werts.....		Evansville, Ind.
Wood Mosaic Co.....		New Albany, Ind.
Mowbray & Robinson.....		Cincinnati, Ohio

2. VEHICLE STOCK PLANTS.

(Using logs, bolts and billets of hickory, white oak and red oak.)

Name	County	Post Office
Alva Sanders (spokes).....	Boyd.....	Ashland & Normal
Pinne and Daniels.....		Burnside
Sturm Lbr. Co. (wagon wood stock).....		Calhoun
Archibald Wheel Co.....		Campbellsville

Name	County	Post Office
Kentucky Singletree & Spoke Co.....		Campbellsville
Fletcher & McGlove (rims).....		Clay City
Kentucky Singletree & Spoke Co..Adair.....		Kirigo, Knifley and McGaha
Fonthill Spoke Co.....	Russell	Fonthill
Bruce Mfg. Co.....		Garrison
Hawesville Hub & Mfg. Co.....		Hawesville
Hickman Wagon Co.....		Hickman
Fulton, Conway & Co.....		Louisville
W. H. Gillett.....		Louisville
Hilton-Collins Co.....		Louisville
Kentucky Rim & Shaft Co.....		Louisville
Yosemite Singletree Co.....	Casey	Middleburg
Bassett Hardwood Mfg. Co.....		Monticello; also at Columbia
Kentucky Hardwood Lumber Co.....		Monticello
Morehead Spoke Co.....		Morehead
McGhone Bros.....		Morehead
Owensboro Wheel Co.....		Owensboro
Carriage Woodstock Co.....		Owensboro
Lack Singletree Co.....		Paducah
J. W. Little.....		Paducah
Big Sandy Spoke Co.....		Pikeville
Pikeville Spoke Co.....		Pikeville
Saunders & Stagg (spokes).....	Fleming	Plummers Landing
Rover Wheel Co.....		Salt Lick
J. W. Allen.....		Scottsville
Columbia Singletree Co.....		Somerset
Geo. C. Kelch.....		Wickliffe
Rock City Spoke Co.....		Nashville, Tenn.

3. TIE, POLE AND PILE BUYERS.

Town	Firm Name
Bowling Green (Warren Co.).....	Ayer & Lord Tie Co.
Bardwell	Dunbar Mill & Lbr. Co. (switch ties & piling)
Buckhorn (Perry Co.).....	Moore, W. M.
Buckhorn (Perry Co.).....	Eversole, A. B.
Buckhorn (Perry Co.).....	Huff & Findley
Burnside (Pulaski Co.).....	Ayer & Lord Tie Co.
Caneyville (Grayson Co.).....	Bond, T. M.
Cloverport (Breckinridge Co.).....	Weatherholt, Marion
Crab Orchard (Lincoln Co.).....	R. L. Collier (poles)
Custer (Breckinridge Co.).....	Breckinridge Tie Co.
Danville	Taylor & Moss

Town	Firm Name.
East View (Hardin Co.).....	Young, H. V., & Co.
Elizabethtown (Hardin Co.).....	Bond Bros. (Inc.)
Eubank (Pulaski Co.).....	Nelson, J. R.
Greenup (Greenup Co.).....	Collins, J. W.
Greenup (Greenup Co.).....	Wilson & Briggs (poles and ties)
Hardinsburg (Breckinridge Co.).....	Ball & Mills
Jackson (Breathitt Co.).....	Ohio Valley Tie Co.
Leitchfield (Grayson Co.).....	Gardner & Fentress
Lexington (Fayette Co.).....	Buskirk-Rutledge Lbr. Co.
Lexington	J. W. Johnson Co.
Louisville (Jefferson Co.).....	American Creosoting Co.
Louisville (Jefferson Co.).....	Hughes, W. J., & Sons Co.
Louisville	Ohio Valley Tie Co.
Middleburg (Casey Co.).....	Short, W. G.
Paducah (McCracken Co.).....	Ayer & Lord Tie Co.
Paducah (McCracken Co.).....	Bartee Tie Co.
Paducah (McCracken Co.).....	Paducah Pole & Timber Co.
Paducah (McCracken Co.).....	A. B. Smith Lbr. Co. (piling and poles)
Providence (Webster Co.).....	Ohio Valley Tie & Lumber Co.
Quincy (Lewis Co.).....	Lowder, J. D.
Panola (Madison-Jackson Co.).....	Estill Lbr. Co. (poles, posts and ties)
Rothwell (Menfee Co.).....	Rothwell Tie Co. (not inc.)
Sacramento (McLean Co.).....	Sacramento Lbr. Co.
Science Hill (Pulaski Co.).....	Langdon, Cyrus M.
Scottsville (Allen Co.).....	Braswell Tie & Log Co.
Shepherdsville (Bullitt Co.).....	Krone & Griffin
Somerset (Pulaski Co.).....	Buskirk-Rutledge Lbr. Co.
Stanton (Powell Co.).....	Hardwick, J. H.
Williamsburg (Whitley Co.).....	Whitley County Stave Co.
Chicago, Ill.....	Chicago Mill & Lbr. Co. (black locust poles, posts and piling)
Chicago, Ill.....	Lake Superior Piling Co.
St. Louis, Mo.....	Berthold & Jennings Lbr. Co. (piling, poles and ties)
St. Louis, Mo.....	George M. Griffin (piling and poles)
St. Louis, Mo.....	Hearne Timber Co. (piling and poles)

4. VENEER MILLS.

(Using logs and bolts.)

Name	County	Post Office
Young, J. H.....	Adair.....	Columbia, Ky.
Read & Co., J. D.....	Allen.....	Scottsville, Ky.
Potter Lbr. Co., The Roy.....	Breathitt.....	Hays, Ky.
Mengel Box Co.....	Fulton.....	Hickman, Ky.
Kentucky Veneer Works.....	Jefferson.....	Louisville, Ky.
Anderson Veneer & Sawmill.....	Jefferson.....	Louisville, Ky.
Davis Lumber Co., Edmund L.....	Jefferson.....	Louisville, Ky.
New Albany Box & Basket Co.....	Jefferson.....	Louisville, Ky.
Southern Veneer Mfg. Co., Inc.....	Jefferson.....	Louisville, Ky.
Louisville Veneer Mills.....	Jefferson.....	Louisville, Ky.
Mengel & Bro., C. C.....	Jefferson.....	Louisville, Ky.
Herbert, H. M.....	Jefferson.....	Buechel, Ky.
Mann, John.....	Lewis.....	Rugless, Ky.
		P. O. Vanceburg, Ky.
Paducah Box & Basket Factory.....	McCracken.....	Paducah, Ky.
Hamlett, J. C.....	McCracken.....	Hickory Grove, Ky., R. D.
Chicago Veneer Co.....	Pulaski.....	Burnside, Ky.
Maley, Thompson & Moffet Co.....		Cincinnati, O.
Talbert-Zoller Lbr. Veneer Co.....		Cincinnati, O.
Indiana Veneer & Lbr. Co.....		Indianapolis, Ind.
Indianapolis Sawed Veneer Co.....		Indianapolis, Ind.
National Veneer & Lbr. Co.....		Indianapolis, Ind.
Gemmer Veneer & Lbr. Co.....		Indianapolis, Ind.
Wood Mosaic Co.....		New Albany Ind.
Roberts & Conner.....		New Albany Ind.
Evansville Dimension Co.....		Evansville, Ind.
Singer Mfg. Co.....		Carlo, Ill.
J. N. Roberts Mfg. Co.....		Metropolis, Ill.
Portsmouth Veneer & Panel Co.....		Mound City, Ill.
St. Louis Box & Basket Co.....		St. Louis, Mo.
Penrod Walnut & Veneer Co.....		Sheffield, Mo.

5. SLACK COOPERAGE PLANTS.

Name	County	Post Office
Bowen, D. J.....	Adair.....	Knifley, Ky.
Read, J. D., & Co.....	Allen.....	Scottsville, Ky.
Vaughan, John	Barren.....	Glasgow Jct. Ky.
Harry, J. T.....	Bath.....	Olympia, Ky.
Hazel Brick & Tile Co. (Lowry, C. E., Pavey, T. E., & Maddox, R. H.)	Calloway.....	Hazel, Ky.

Name	County	Post Office
Willis, J. M.....	Calloway.....	Brandon, Ky.
Scobes, R. P., & Sons Co.....	Christian.....	Winchester, Ky.
Davis & Long.....	Clinton.....	Seventy Six, Ky.
Bowman, J. S.....	Fleming.....	Wallingford, Ky.
Mills, A. P.....	Fulton.....	Hickman, Ky.
Carter, O. J.....	Green.....	Mell, Ky.
Boggs, James & Son.....	Greenup.....	Warnock, Ky.
Rineyville Roller Mills (H. Hobart & Rufus Osborne).....	Hardin.....	Rineyville, Ky.
Weir Bros.....	Hopkins.....	Hanson, Ky.
McQueen, Harvey.....	Jackson.....	Highknob, Ky.
Poynter, J. H.....	Laurel.....	London, Ky.
Lowder, G. W., & Sons.....	Lewis.....	Rexton, Ky.
Hillman Land & Iron Co.....	Lyon.....	Kuttawa, Ky.
Mitchell, W. J.....	Lyon.....	Rinaldo, Ky.
Sherrill-King Mill & Lbr. Co.....	McCracken.....	Paducah, Ky.
Quigg Mfg. Co., The.....	McLean.....	Livermore, Ky.
Smith Cooperage Co.....	McLean.....	Livermore, Ky.
Mathews, W. B., & Co.....	Mason.....	Maysville, Ky.
Dodson, L. E.....	Metcalf.....	Echo, Ky.
Moseley, B. F.....	Muhlenberg.....	Brucken, Ky.
Sherman, A. W.....	Nelson.....	Samuels, Ky.
Washington Mfg. & Min. Co.....	Nicholas.....	Myers, Ky.
Leon Stave Co.....	Rowan.....	Morehead, Ky.
Largin, R. L.....	Rowan.....	Hilda, Ky.
Rockville Heading Co.....	Rowan.....	Freestone, Ky.
Gaskins, Jullius L.....	Russell.....	Russell Spgs., Ky.
Brown, A. F., & Sons.....	Spencer.....	Dale, Ind.
Phillips Bros.....	Taylor.....	Mannsville, Ky.
Cowan, W.....	Todd.....	Trenton, Ky.
Wisdom, John, & Son.....	Jackson.....	Sabula, Iowa

6. PULP AND EXCELSIOR PLANTS.

Name	Post Office
Burnside Excelsior Co.....	Burnside, Ky.
Caummisar, T. C.....	Louisville, Ky.
Meade Pulp and Paper Co.....	Chillicothe, O.
Johnson Excelsior Co.....	Indianapolis, Ind.
F. Burkard Mfg. Co.....	St. Louis, Mo.
	(Excelsior)

7. TANBARK AND WOOD-EXTRACT USERS AND PLANTS.

Name	Post Office
Ames Oak Leather Co.....	Louisville, Ky.
Excelsior Oak Tanning Co.....	Louisville, Ky.
Falls City Tannery.....	Louisville, Ky.

Name	County	Post Office
Globe Tanning Co.....		Louisville, Ky.
Wm. Hopkins Sons.....		Louisville, Ky.
Louisville Leather Co.....		Louisville, Ky.
National Oak Leather Co.....		Louisville, Ky.
Richard Ritter		Louisville, Ky.
Wm. Schuff & Co.....		Louisville, Ky.
The Chas. Stoecker Co.....		Louisville, Ky.
Wadekind-Hollenberg Tanning Co.....		Louisville, Ky.
Union Tanning Co. (Bell County).....		Middlesboro, Ky.
Ashland Leather Co.....		Ashland, Ky.
John G. Decker & Sons Co.....		Owensboro, Ky.
Kentucky Hide & Leather Co. (Kenton County).....		Ludlow, Ky.
Paducah Tanning Co.....		Paducah, Ky.
Gusdorg, S. M.....		Indianapolis, Ind.
W. F. McMurren Estate.....		Salem, Ind.
W. W. Mooney & Sons.....		Columbus, Ind.
August Barth Leather Co.....		New Albany, Ind.
The Day Leather Co.....		New Albany, Ind.
Indiana Leather Co.....		New Albany, Ind.
Geo. Moser & Co.....		New Albany, Ind.
Southern Extrac ^t Co.....		Knoxville, Tenn.
American Oak Leather Co.....		Harriman, Tenn.
Kragon-Wood Co. (Breathitt County).....		Kragon, Ky.
J. P. White & Co. (Trigg County).....		Hematite, Ky.
Jos. Smithline (Scioto County).....		Franklin Furnace, O.
Jefferson Iron Co. (Jackson County).....		Oak Hill, O.

8. HANDLE FACTORIES.

(Using chiefly hickory, and some white oak and ash.)

State	Town	Firm Name
Illinois.....	Cairo.....	Clark-Danforth Handle Co.
	Cairo.....	Wm. Haas & Sons
Indiana.....	Alton.....	Peckinpough, Harrison & Co.
	Corunna.....	Reynolds Bros.
	Vincennes.....	Indiana Handle Co.
Kentucky.....	Amandaville.....	S. T. Shannon
	(Cumberland Co.)	
	Calhoun (McLean Co.).....	Calhoun Handle Co.
	Calhoun (McLean Co.).....	Green River Co.
	Curtis (Metcalf Co.).....	E. J. Davis
	Dawson Springs.....	R. Burley & Sons
	(Hopkins Co.)	
	Glasgow.....	Carpenter & Baylis Co.
	Glasgow.....	Turner-Day-Woolworth Handle Co.

State	Town	Firm Name
Kentucky.....	Kuttawa.....	Kuttawa Handle Works
	Louisville.....	B. F. Avery & Sons
	Louisville.....	Quigg Broom Handle Co.
	Livermore.....	Quigg Broom Handle Co.
	London.....	Quigg Broom Handle Co.
	New Haven.....	Quigg Broom Handle Co.
	Owensboro.....	Owensboro Shovel & Tool Co.
	Princeton.....	Quigg Broom Handle Co.
	Red Lick (Metcalf Co.)	Cummings & Co.
	Scottsville.....	Quigg Broom Handle Co.
Missouri.....	Bowling Green.....	Turner-Day-Woolworth Handle Co.
	Caruthersville.....	Geo. C. Peattie
	Dexter.....	I. X. L. Handle Mfg. Co.
Ohio.....	Poplar Bluff	Hanna & Young Handle Co.
	Poplar Bluff	Piqua Handle Co. (chiefly ash)
	Washington C. H.....	Washington Handle Co.

9. MISCELLANEOUS USERS

(Of Logs and bolts.)

Columbia Column Co., Lebanon, Ky. (Small poplar logs.)
 Little & Wright, Jackson, Ky. (Shuttle blocks.)
 Anchor Boat Oar Co., Memphis, Tenn. (Select ash and hickory logs, and dogwood and persimmon bolts.)
 Oil Well Supply Co., Memphis. (Ash and hickory logs.)
 Harriman Shuttle Block Co., Harriman, Penn. (Dogwood and persimmon.)
 Weber Mfg. Co., Louisville, Ky. (Baseball bats, ash.)
 Irvington Hardware and Implement Co., Irvington, Ky.
 Fulton Stirrup Co., Fulton, Ky. (Stirrups and handle ash and hickory.)

10. USERS OF CEDAR.

(Logs and bolts.)

Pope & Humphrey, Bowling Green.
 J. P. Meredith Cedar Co., Nashville, Tenn., and Horse Cave, Ky.
 F. and O. Cedar Works, Nashville, Tenn., and Burnside, Ky.
 Gernet Bros. Lbr. Co., Louisville. (Cedar posts.)
 Burnside Mfg. Co., Burnside, Ky. (Cedar faucets.)
 A. B. Smith Lbr. Co., and Rowletts (Hart Co.), Cave City, Ky. (Cedar posts.)
 Houston & Liggett, Russellville.
 Western Cedar Co., Rockfield, Ky. (Warren Co.)
 Edgett & Ellis Co., Somerset, Ky.
 D. W. Martin, Rosslyn, Ky.

11. BUYERS OF BLACK WALNUT LOGS.

State	Town	Firm Name
Illinois.....	Belvidere.....	National Sewing Machine Co.
	Cairo.....	Singer Mfg. Co.
	Chicago.....	R. S. Bacon Veneer Co.
	Kankakee.....	Foley & Williams
	Rockford.....	Illinois Sewing Machine Co.
	Chicago.....	C. L. Willey
Indiana.....	Fort Wayne.....	Hoffman Bros. Co.
	Indianapolis.....	Indiana Veneer and Lbr. Co.
	Indianapolis.....	The Talga Mahogany Co.
	Lawrenceburg.....	Batesville Lbr. and Veneer Co.
Maryland.....	Baltimore.....	Williamson Veneer Co.
Missouri.....	East St. Louis.....	East St. Louis Walnut Co.
	Kansas City.....	Penrod Walnut and Veneer Co.
	St. Louis.....	Pickerel Walnut Co.
North Carolina.....	Lenoir.....	Lenoir Veneer Co.
Ohio.....	Cincinnati.....	The Ohio Veneer Co., 2624 Colerain Ave.
	Dayton.....	H. C. Hossafores
	Piqua.....	George W. Hartzell
Pennsylvania.....	Philadelphia.....	A. H. Fox Gun Co.

12. TIGHT COOPERAGE PLANTS AND DEALERS

(Using logs, bolts and billets of white and red oak.)

Name	County	Post Office
Chess & Wymond Co.....	Jefferson.....	Louisville, Ky.
Taylor & Moss.....	Adair.....	Greensburg, Ky.
Chastain, T. H.....	Adair.....	Keltner, Ky.
McKinley, R.....	Adair.....	Graycroft, Ky.
Pulliam, Thomas.....	Adair.....	Fair Play, Ky.
Elrod & Co.....	Adair.....	Columbia, Ky.
Bowen, D. J.....	Adair.....	Knifley, Ky.
Asher, A. J., Jr.....	Bell.....	Wasioto, Ky.
Asher & Son, T. J.....	Bell.....	Tejay, Ky.
Ross, Henry.....	Boyd.....	Rush, Ky.
Pritchard & Banfield.....	Boyd.....	Rush, Ky.
Harris, J. F.....	Breathitt.....	Lost Creek, Ky.
Patton (Roy) Lumber Co., The.....	Breathitt.....	Hays, Ky.
Dennis & Lisle.....	Breathitt.....	Houston, Ky.
Werner Stave Co., Louis.....	Caddo.....	Shreveport, La.
Hazel Brick & Tile Co., (Lowry, Pavey & Maddow).....	Calloway.....	Hazel, Ky.
White & Son, J. T.....	Calloway.....	Hazel, Ky.
Jasper Bros.....	Casey.....	Mintonville, Ky.

Name	County	Post Office
Wallen, Theo.....	Casey.....	Creston, Ky.
Kentucky Stave Co. (not a mfr.).....	Christian.....	Louisville, Ky.
Martin Stave Co., Ltd., The.....	Claiborne.....	Haynesville, La.
Saulsbury, E. G.....	Clay.....	Bright Shade, Ky.
Taylor & Moss.....	Cumberland.....	Greensburg, Ky.
Winfrey Stave & Lbr. Co., Inc.....	Cumberland.....	Somerset, Ky.
Evans, Drew	Elliott.....	Sandy Hook, Ky.
McFarland, Jas.....	Elliott.....	Gimlet, Ky.
King, J. N.....	Elliott.....	Newfoundland, Ky.
Brown, Wales S.....	Elliott.....	Ordinary, Ky.
Russell, Frank B.....	Estill.....	Irvine, Ky.
Cooper Brothers	Fleming.....	Nisi, Ky.
Taylor & Moss.....	Green.....	Greensburg, Ky.
Kentucky Stave & Tie Co.....	Harlan.....	Harlan, Ky.
Balst Cooperage Co., Ltd., L.....	Iberville.....	Plaquemine, La.
Congleton, Lee.....	Jackson.....	Gray Hawk, Ky.
Lang, J. E.....	Knott.....	Jackson, Ky.
Smith, J. & C.....	Knox.....	Hooper, Ky.
Beard, J. H.....	Laurel.....	Altamont, Ky.
Hibbard & Steele.....	Laurel.....	London, Ky.
Edwards, D. C.....	Laurel.....	London, Ky.
Congleton, Lee.....	Lee.....	Evelyn, Ky.
Congleton, Hill.....	Lee.....	Banford, Ky.
Cincinnati Cooperage Co.....	Lee.....	Heidelberg, Ky.
Congleton, Price	Lee.....	Idamay, Ky.
Adams & Sons Co., Ltd., J. A.....	Lincoln.....	Ruston, La.
Kentucky Stave Co.....	Logan.....	Russellville, Ky.
Salversville Stave Co., The.....	Magoffin.....	Hager, Ky.
Arnett & Sons, C. B.....	Magoffin.....	Sublett, Ky.
Edelin, E. A.....	Marion.....	Raywick, Ky.
Chrisman & Co., N. L.....	Marshall.....	Benton, Ky.
Pearson, Abram.....	Martin.....	Pilgrim, Ky.
Taylor & Moss.....	Metcalf.....	Greensburg, Ky.
Maggord & Co., L. D.....	Morgan.....	Relief, Ky.
Sherman, A. W.....	Nelson.....	Samuels, Ky.
English, Sylvester.....	Owsley.....	Earnestville, Ky.
Fell, W. J.....	Pike.....	Hellier, Ky.
Rush, H. G.....	Pike.....	Pikeville, Ky.
Karr, Frank C.....	Pike.....	Stewart, Ky.
Bauer Cooperage Co., The.....	Pulaski.....	Bauer, Ky.
McDowell, J. B.....	Pulaski.....	Elgin, Ky.
Cornett, H. B.....	Pulaski.....	Public, Ky.
Coyler, John	Pulaski.....	Somerset, Ky.
Humble, A. R.....	Pulaski.....	Somerset, Ky.
Powell & Cunningham.....	Rockcastle.....	Cochland, Ky.
Wells, J. W.....	Rowan.....	Elliottsville, Ky.

Irwin, J. D., Jr.....	Russell.....	Creelsboro, Ky.
Earles, R. P.....	Taylor.....	Campbellsville, Ky.
Morgan & Marple.....	Taylor.....	Campbellsville, Ky.
Bauer Cooperage Co.....	Wayne.....	Monticello, Ky.
Coffey, C. C.....	Wayne.....	Monticello, Ky.
Hutchinson, E. D.....	Wayne.....	Frazer, Ky.
Thielen, G. P.....	Whitley.....	Carpenter, Ky.
Harp, J. H.....	Whitley.....	Tidalwave, Ky.
Chess & Wymond Co.....	Whitley.....	Louisville, Ky.

13. WOOD-USING FIRMS IN KENTUCKY CONSUMING SAWED LUMBER.

(Firms which, for the most part, use over one-half million feet a year.)

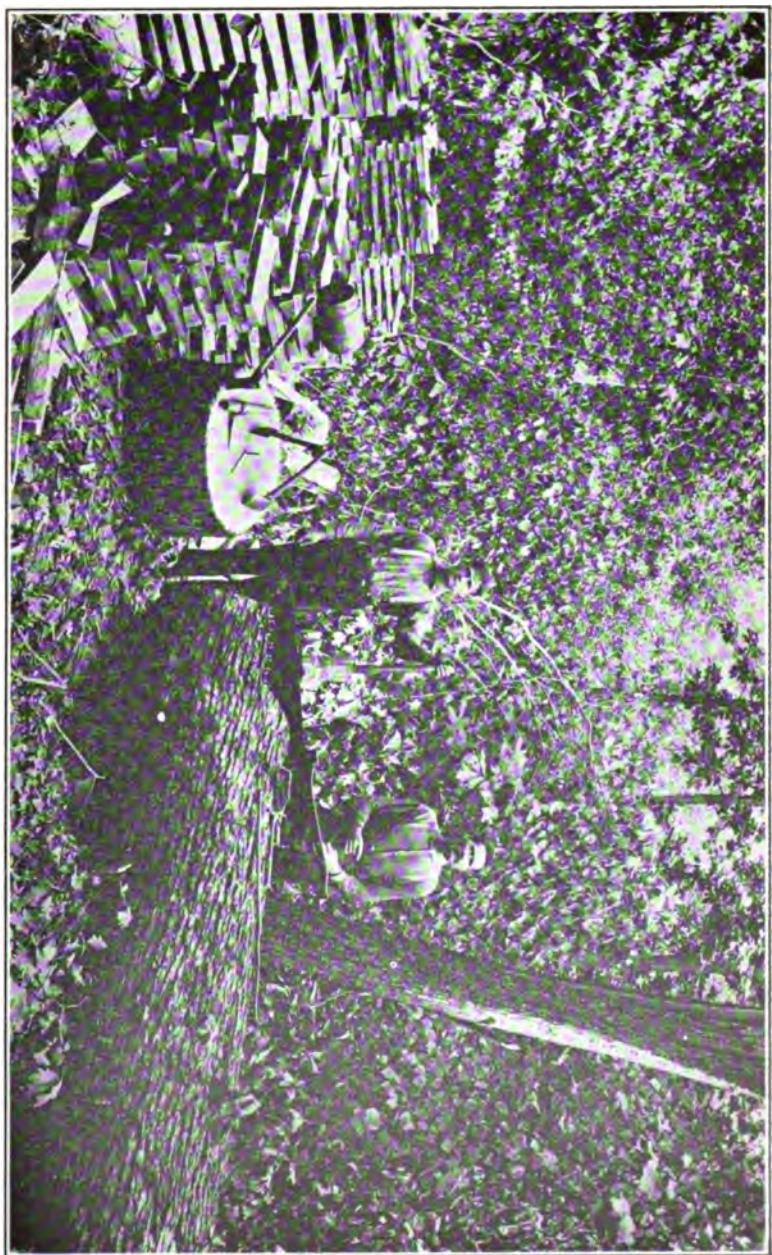
H. Hermann Co.....	Ashland
Ashland Lumber Co.....	Ashland
Standard Planing Mill Co.....	Ashland
Knoedler Mfg. Co.....	Augusta
W. G. Ward.....	Bardwell
Bowling Green Furniture Co.....	Bowling Green
Roemer Bros.....	Bowling Green
Carrollton Furniture Co.....	Carrollton
Linehan Lbr. Co.....	Catlettsburg
Swan-Day Lumber Co.....	Clay City
Acme Box Co.....	Covington
Chas. Brandstetner Co.....	Covington
Ohio Scroll and Lbr. Co.....	Covington
Chesapeake & Ohio Ry. Co.....	Covington
Bellvue Planing Mill Co.....	Dayton
Harvard Piano Co.....	Dayton
Jenkins & Essex Lbr. Co.....	Elizabethtown
Burt & Brabb Lbr. Co.....	Ford
Kentucky Furniture Co.....	Frankfort
Henderson Desk Co.....	Henderson
Marshall Furniture Co.....	Henderson
F. L. Clore & Sons.....	Henderson
George Delker Buggy Co.....	Henderson
Delker Bros. Buggy Co.....	Henderson
Coquillard Wagon Works.....	Henderson
Henderson Wagon Works.....	Henderson
Hickman Wagon Works.....	Hickman
Gamble Bros.....	Highland Park
Wood Mosaic Co.....	Highland Park
Continental Car & Equipment Co.....	Highland Park
Forbes Mfg. Co.....	Hopkinsville

Mogul Wagon Works.....	Hopkinsville
Combs Lbr. Co.....	Lexington
Hendricks, Moore & Young.....	Lexington
Green River Chair Co.....	Livermore
London Mfg. Co.....	London
Adler Organ Co.....	Louisville
Frank B. Alford Co.....	Louisville
B. F. Avery & Sons.....	Louisville
Beckwith Organ Co.....	Louisville
Brinkhans & Black (trunks).....	Louisville
Bell & Coggeshall Co.....	Louisville
Columbia Mantel Co.....	Louisville
Dantrick Cigar Box Mfg. Co.....	Louisville
W. E. Cadwell & Co. (tanks).....	Louisville
Kentucky Lbr. & Mill Work Co.....	Louisville
Kentucky Hardwood Flooring Co.....	Louisville
Kentucky Wagon Works.....	Louisville
Peter Jacobson	Louisville
William Kopp	Louisville
Henry Kochler	Louisville
The Alfred Struck Co.....	Louisville
Lartz & Frey.....	Louisville
Louisville Mfg. Co.....	Louisville
Louisville Planing Mill Co.....	Louisville
Lanham Hardwood Flooring Co.....	Louisville
Lansberg & Macks.....	Louisville
Lamb Bros. (trunks).....	Louisville
Moody-Mitchell Lbr. Co.....	Louisville
National Casket Co.....	Louisville
Louisville & Nashville R. R. Co.....	Louisville
McMillan Mfg. Co.....	Louisville
Mengel Box Co.....	Louisville
Ruth Bros.....	Louisville
Southern Planing Mill Co.....	Louisville
Palmer & Hardin (furniture).....	Louisville
Tyler Box Co.....	Louisville
J. T. Will Co.....	Louisville
Wilson Furniture Co.....	Louisville
The Jefferson Wood Works Co.....	Louisville
Voss Mantel Co.....	Louisville
Adler Mfg. Co. (musical instruments).....	Lyons
Ohio Valley Pulley Works.....	Maysville
Ruby Lumber Co.....	Madisonville
Mayfield Lumber Co.....	Mayfield
Higgins Mfg. Co.....	Newport
Fred Miller (planing mill).....	Newport
Nicholasville Lbr. Co.....	Nicholasville

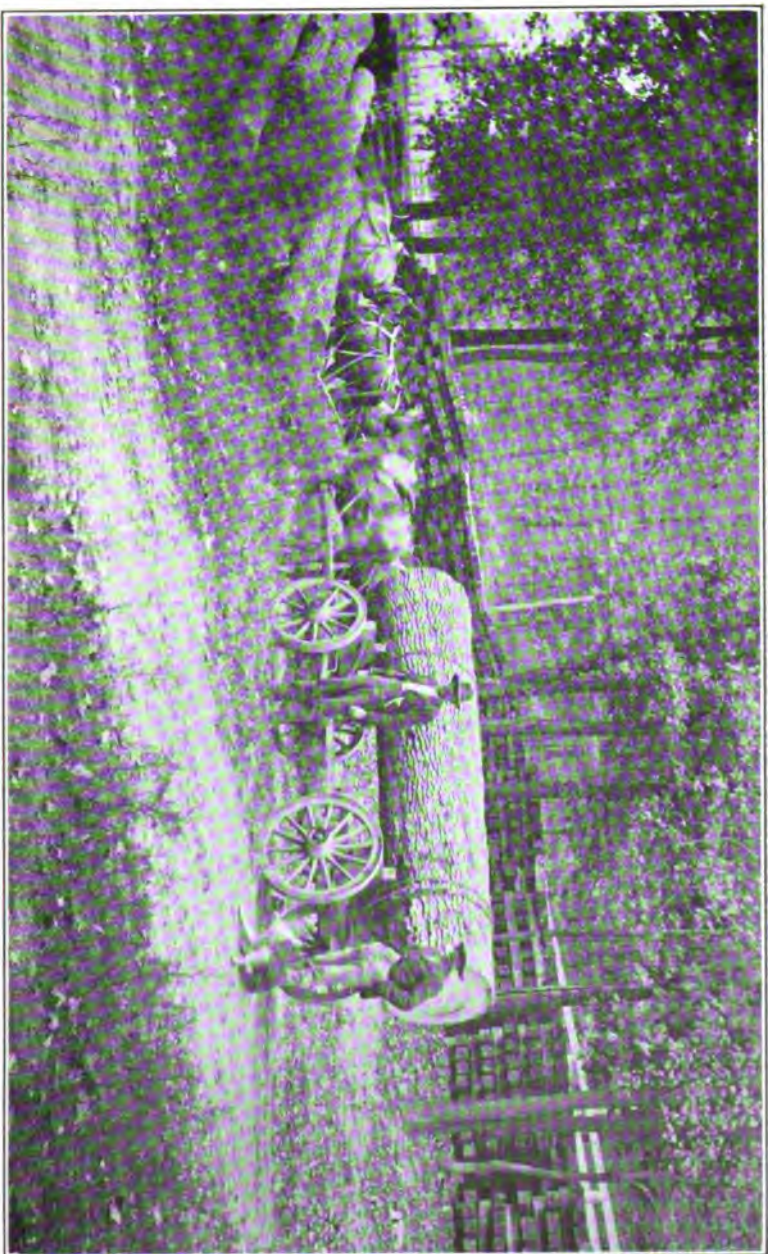
Home-Building Planing Mills.....	Owensboro
Hickman-Ebbert Co. (vehicles).....	Owensboro
Owensboro Wagon and Buggy Co.....	Owensboro
Barnes-Kelly Mfg. Co.....	Owensboro
Paris Lumber & Mfg. Co.....	Paris
Langstaff-Orm Mfg. Co.....	Paducah
Ed Roos Co. (fixtures, etc.).....	Paducah
Sherrill-Russell Co.....	Paducah
Vine Grove Lbr. Co.....	Vine Grove
McDaniel's Mfg. Co.....	Warsaw
The Warsaw Furniture Mfg. Co.....	Warsaw
Reliance Mfg. Co.....	Winchester



Stand of Large White Oaks Which Will Make Select Saw and Veneer Logs, Lyon County, Ky.



Getting Out Rived Staves of White Oak for the Tight Cooperage Industry, Showing Tools Used.



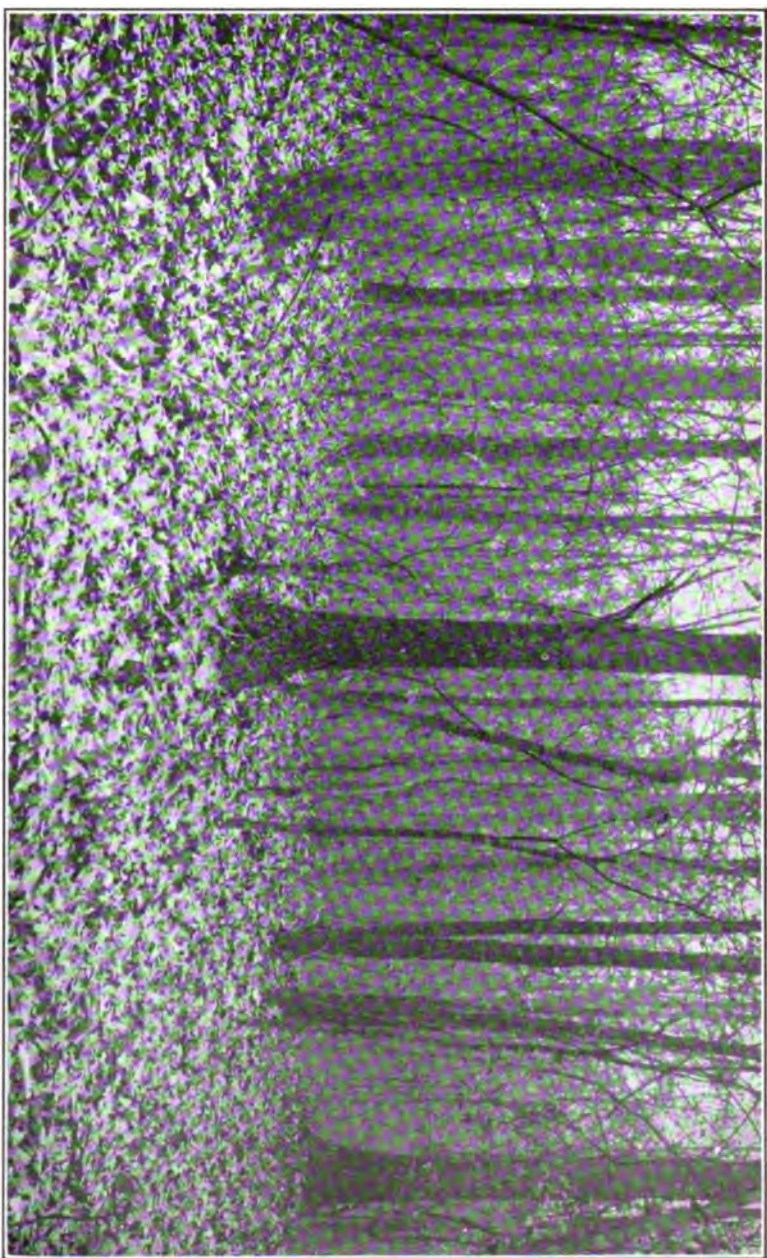
Thirty-four Inch White Oak Log, Scaling 800 Feet, Being Hauled to Railroad for Shipping to Large Mill.



Giant White Oak in Mixture With Beech, Bell County, Ky.



White Oak, Red Oak, Poplar and Chestnut. A Typical Forest of the Central Highland Region.



Typical Mixed Oak, Chestnut and Poplar Woodlot, Partially Cut Over Thirty-one Years Ago, Mammoth Cave, Ky.
Trees of All Diameters are Represented.



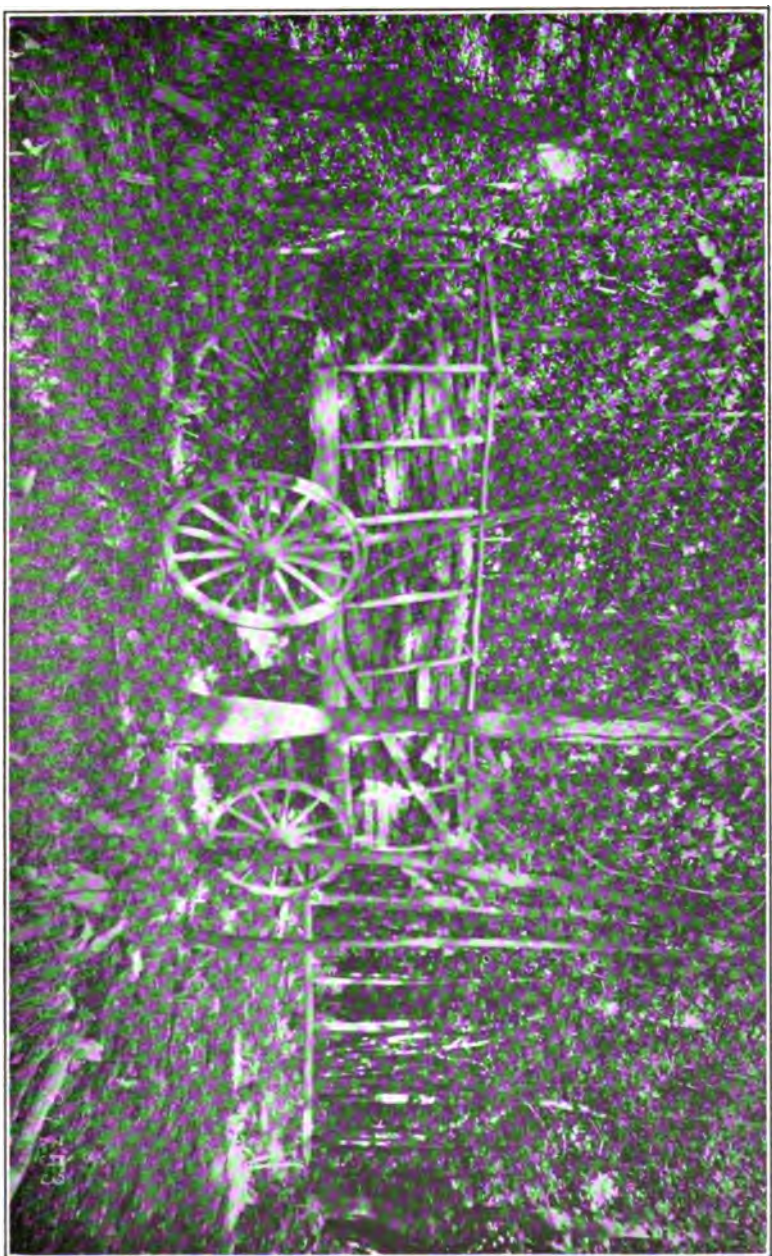
Dense Stand of Small White Oak, Which Could Be Profitably Thinned Out for Railroad Ties, Leaving the Best Trees to Grow for Saw Timber.



Raft of Oaks, Poplar and Other Hardwood Logs at Ashland, Ky. Transportation of Logs for Long Distances by Water, Where Available, is Always Very Cheap.



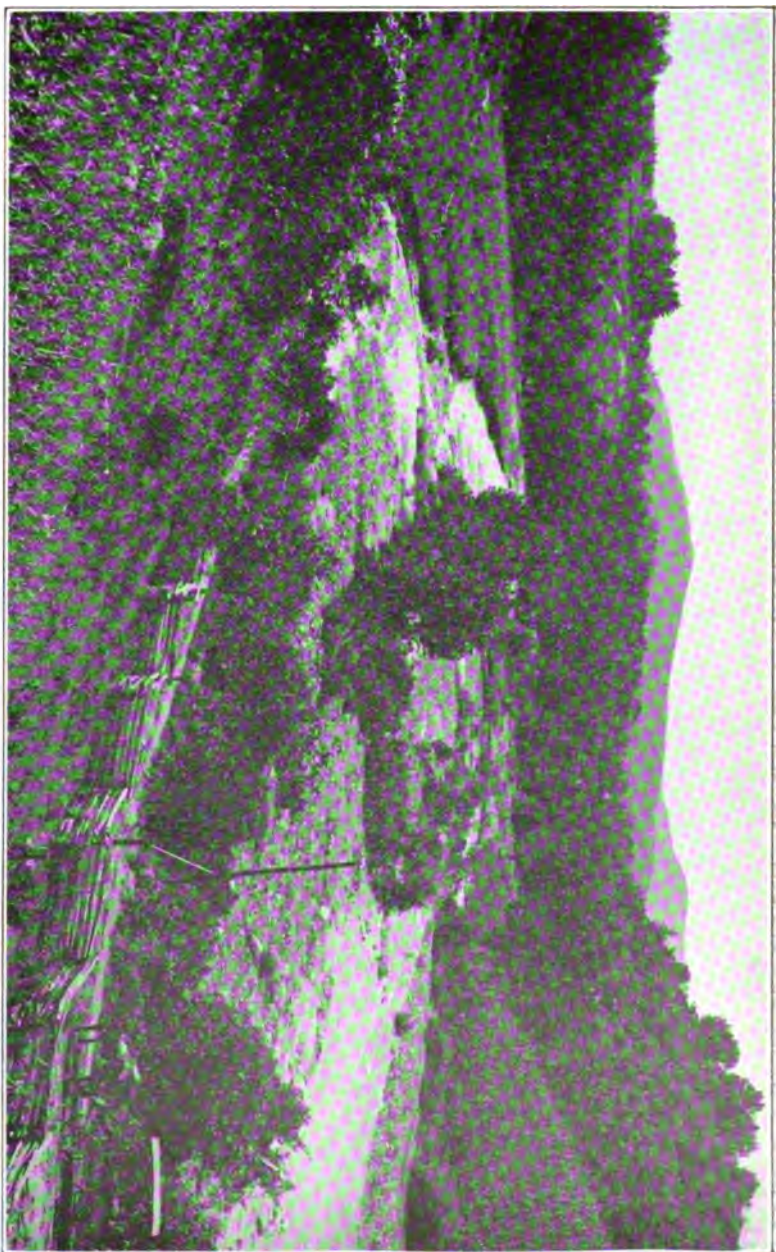
Wasteful Utilization—Black Walnut Cut Into Railroad Ties in Lyon County, Ky.



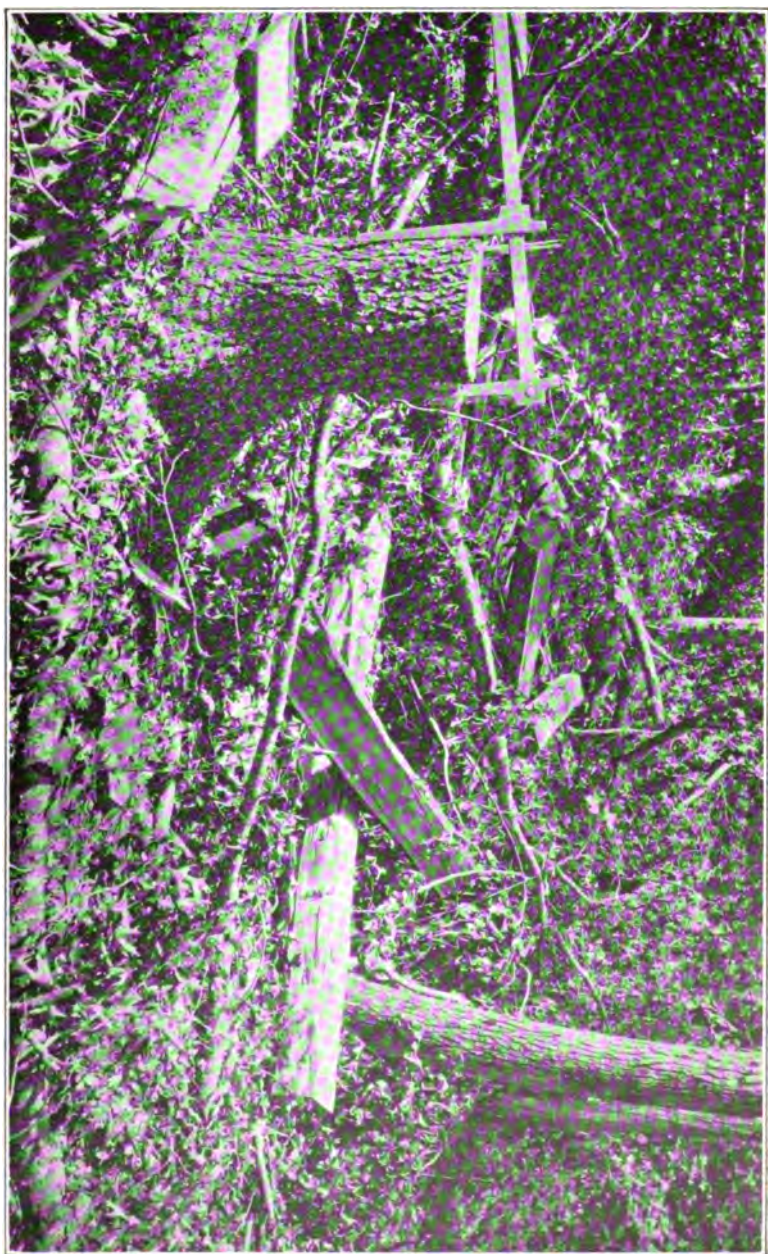
Tan Bark Wagon Nearly Loaded. About a Cord is Hauled at a Load.



Fig. 23. The Canadian Goldenrod (*Solidago canadensis*), as it grows in thickets about Lexington, Ky.



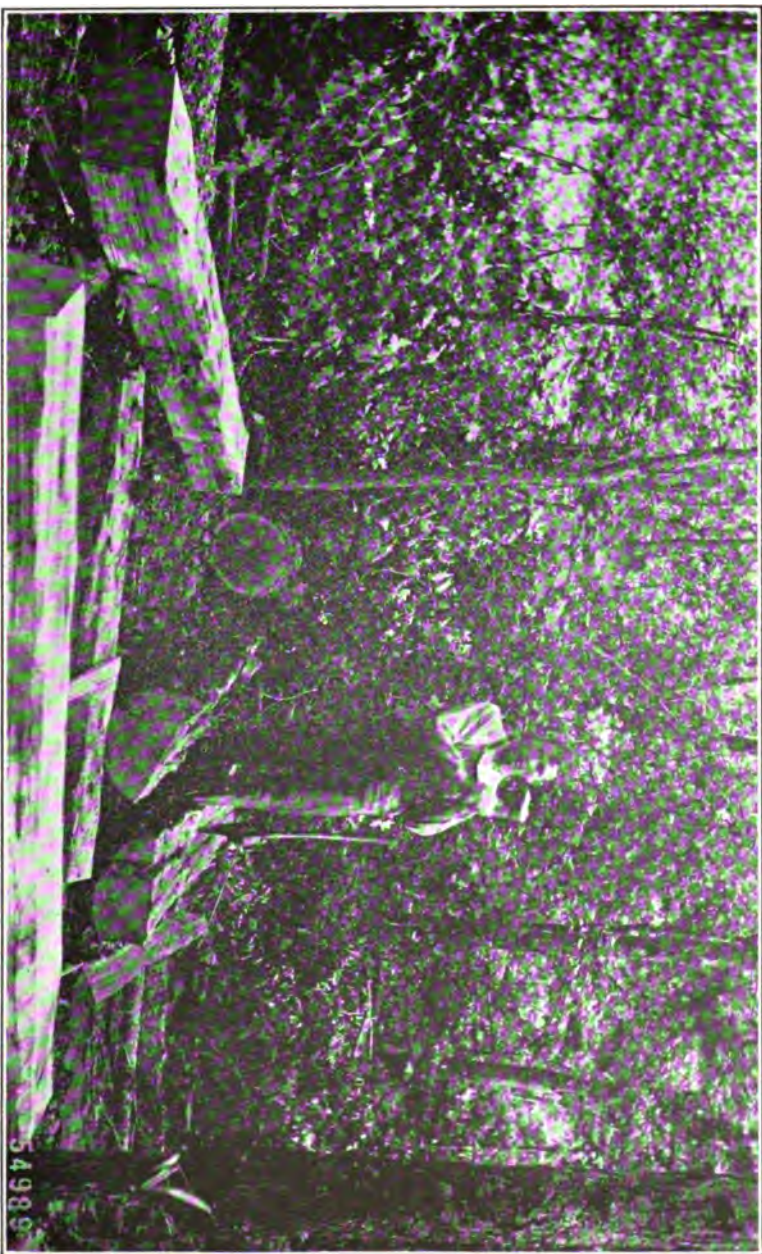
A forty-acre alluvial bottom very badly washed by a freshet. The creek formerly ran to the left of the row of sycamores in the middle of the picture, which marked its right bank. It now runs along the foot of the hill on the right.



Black Cherry Cut Into Railroad Ties.



Waste in Tie Making. Tree Twenty Inches in Diameter Split in Felling.



Hewing Ties. Third Cut, and Two Ties From Each Cut.



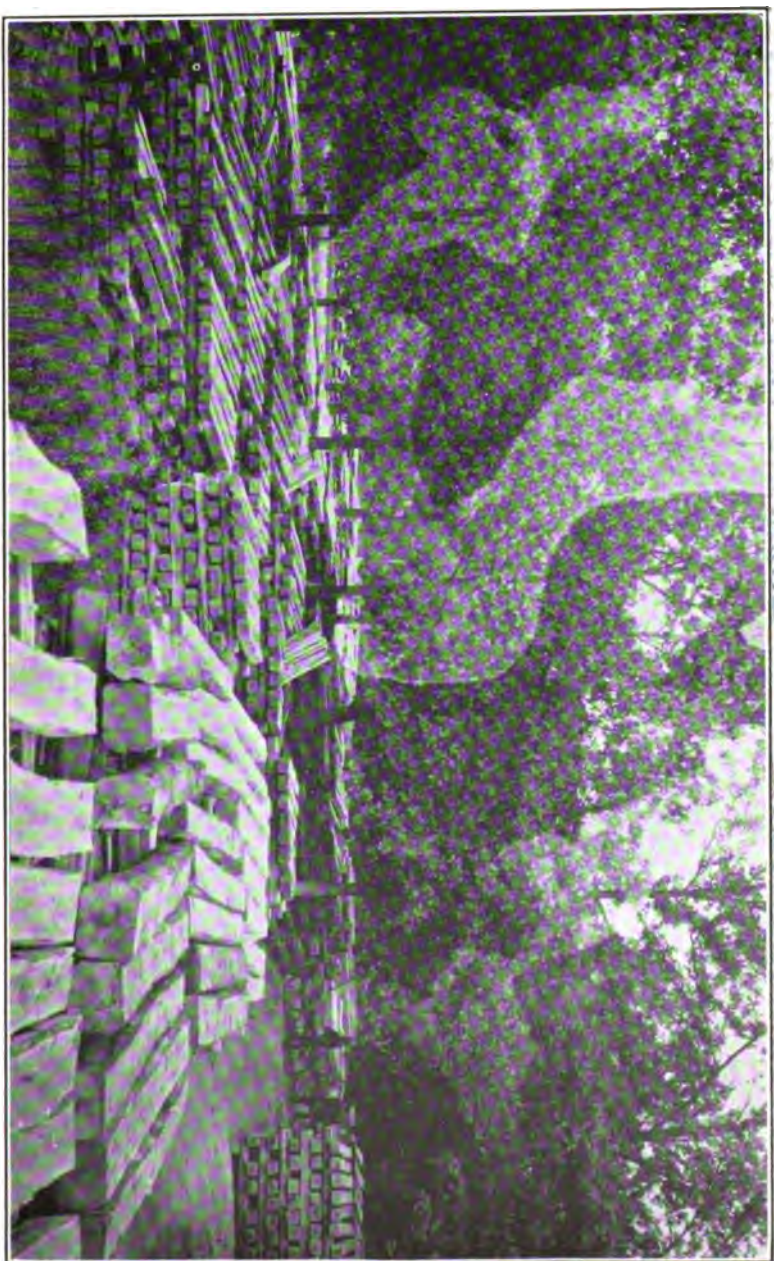
Dense Second Growth Mixed Oak Forest After Cut Over for Ties. All Trees Over Nine Inches in Diameter Were Taken



**Typical Beech Woodlot on North Slope, Above Green River,
Edmonson County.**



A Trail Through Good Forest Growth for Protection Purposes.



Thirty-five Thousand Ties in Tie Yard. A Very Important Industry for Utilizing Woodlot Material.



A Forest Fire in the Mountains.



**Large Top of White Oak Left in the Woods, Union County, Ky.
This is a Common Occurrence.**



Washed Lands. After the Forest is Removed Erosion Begins.



Small Hickory Timber Cut Into Spoke Bolts.



Small Poplar and Pine Bolts Cut for Slack Cooperage Heading.

THIRD
BIENNIAL
REPORT

The State Forester
of Kentucky



1917

Foristry

SII

12

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"SHADY LANE."

A well shaded Kentucky road.
(To get the full effect of the vista, roll a piece of paper and look through it at the view.)

Third Biennial Report

The State Forester of Kentucky

1917

Published by the direction of the State Board of
Forestry.

GOVERNOR A. O. STANLEY,
Chairman.

M. S. COHEN,
Commissioner of Agriculture.

Director, Kentucky Agricultural Experiment Station.

HON. JOHNSON N. CAMDEN,
Versailles.

HON. W. H. MACKOY,
Covington.

MRS. MASON MAURY,
Louisville.

J. E. BARTON, STATE FORESTER.



THE STATE JOURNAL COMPANY
Printer to the Commonwealth
Frankfort, Kentucky.

Forestry Lib
4-9-31

REPORT OF THE STATE FORESTER

INTRODUCTION.

The Third Biennial Report of the State Forester covers the close of the administration of Governor Jas. B. McCreary and the early part of the administration of Governor A. O. Stanley. Since the State Board of Forestry has been operating now for about five years and since the state forest policy has taken a fairly concrete form it is possible at this time to state rather definitely just what a forest policy is doing for Kentucky, and what it may be expected to accomplish in the future. The personnel of the State Board of Forestry has been subject to considerable change within the last year or more. Governor A. O. Stanley has taken the place of Governor Jas. B. McCreary as Chairman of the Board; the Honorable M. S. Cohen, Secretary of Agriculture has superseded Hon. Jas. W. Newman as Commissioner of Agriculture and ex-officio member of the Board. Dr. Joseph Kastle, Director of the Agricultural Experiment Station at Lexington and ex-officio member of the Board, died September 24, 1916, and since no appointment has been made as permanent director of the Experiment Station his place has not as yet been filled. The appointive members of the Board remain the same as heretofore. The term of Mr. W. H. Mackoy, of Covington, expired June 12, 1917. At a meeting of the State Board of Forestry on September 7, 1916, Mr. J. E. Barton was re-appointed State Forester for a term of four years.

EDUCATION.

The same policy of education has been continuously followed in connection with the work of the State Forester's office during the last two years, as in the past, since it has been realized during this period even more clearly than theretofore, that only by unremitting education along forestry lines could a forestry policy become the vital factor in the political economy of the State which its importance demands. The industrial needs of the United States and the European nations, not only during the war but particularly after the war, will greatly emphasize this im-

portance through large demands for timber. It is realized in this connection, too, in the words of a recent government report upon the lumber industry, that "greater economy in the use of wood will become necessary at best when the virgin forests of the United States are exhausted. Severe shortages are certain unless the productive capacity of cut-over forest lands is put to work. Private ownership can do but a part. Public ownership must do the rest, aided by regulation of the handling of private forest lands."

ADDRESSES.

As heretofore, opportunities for addresses concerning forestry and related matters have not been wanting. The State Forester has continued his practice of making addresses at the beginning of circuit courts in the endeavor to emphasize the importance of forestry and particularly forest protection in the State where a strict observance of those sections of the forest laws relative to forest fires means a great economic saving and a great benefit to the State. Addresses were also made before such organizations as the Commercial Club of Covington, the Farmers' Association of Kenton County, Kentucky Academy of Science, the Garden Club of Louisville, the Garden Club of Lexington, the State Farmers' Institute, the College of Berea, the Western Normal at Bowling Green, the Southern Forestry Congress held at Asheville, N. C., in July of 1916, the Architects' and Engineers' Club of Louisville, the National Conservation Congress at Washington in January, 1917, and various smaller gatherings and meetings. The State Forester also arranged the giving of a series of lectures at the Western State Normal on various phases of forestry during the summer session of the school.

STUDIES.

About two years ago the office of the State Forester in conjunction with the Forester for the Consolidation Coal Company, whose Kentucky headquarters are at Jenkins, Kentucky, started a study of the relation of the forests and the consumption of timber products in the State to the coal industry. The scope of this study has been extended very considerably since the original work was begun and has been made to include a large part of the Southern Appalachian coal mining section. Valuable co-operation in this direction has been secured through the office of Private Co-operation of the United States Forest Service.

It is expected that the results of this study will be published at an early date. A large amount of valuable data has come to light in this connection and several surmises which have heretofore lacked confirmation have been definitely worked out.

A study of the sawmills of Kentucky with relation to the output of timber and the effect of this output upon the forests of the State is contemplated during the coming summer.

For 1916, as for the two previous years, the office of the State Forester has undertaken to get a complete record of all the ties, poles and posts used by the railroads, telegraph, telephone, power and light companies in the State. In the past this information has been of great value in a large number of directions, and the completeness of the figures so far obtained this year indicate the results will be even more valuable than those previously obtained.

BULLETINS.

One Bulletin was published by the office of the State Forester during the past two years, Bulletin No. 5, which was a revision and amplification of the Manual of Instructions for County Forest Wardens and District Forest Wardens. Several pamphlets have been published as follows: Circular No. 3, The Forests of Kentucky; Circular No. 4, Progress of Forestry in Kentucky; Circular No. 5, Forestry and the Farm Woodlot, and Circular No. 6, The Use of Treated Timber. All these pamphlets and bulletins have been given wide distribution both in the schools and among the general public. Two circulars are in process of preparation.

FOREST PROTECTION.

It is gratifying to note that during the two years just past the matter of forest protection has taken a firm hold upon the individuals, firms and corporations owning timber in the eastern part of the State, and that there is a keen appreciation of what can be done in the direction of preventing and suppressing forest fires and reducing the amount of annual damage from this source. The Federal Government has continued to allot \$4,000 a year for the use of Kentucky in this work, and this amount, as heretofore, has been chiefly expended in the salaries of wardens in the individual counties. Some change has been made in the working out of this agreement. At the present time the Federal wardens are paid a salary of \$50 a month and their expenses

not to exceed \$1.25 per day. It is felt that the personnel of the county wardens has improved very considerably and that with the experience of the men in this particular line of work the results obtained are a great deal more pronounced.

During 1916 two lookout stations were established in Eastern Kentucky. One is located in Clay County on what is termed Orchard Knob, a point about two miles from Manchester. A forty-foot tower was erected at this point from which it is possible to see a large share of the forest area of Clay County. This lookout station is known as the Orchard Knob Lookout Station. It is not as yet equipped with a telephone line but it is only one mile from telephone communication, and there is a road from the top of the lookout point to the bottom, so that communication is fairly easy. The other point on which a lookout station has been erected is at the junction of Letcher, Knott and Pike Counties. This was erected in conjunction with the Consolidation Coal Company. A lookout tower about 25 feet high was erected here and this tower has proved of very considerable service during the spring of 1917. It is equipped with a telephone.

The fire association in Harlan County after rather an unfortunate experience in the fall of 1916 decided to split up into two associations. Each of these associations will cover a territory of about 100,000 acres. It is felt by the members of the association that in this way a great deal more effective work can be accomplished and more careful administration brought about. During the summer of 1917 it is hoped that more lookout stations may be arranged for than are at the present time. The general fire situation during the past few years is shown in the attached tables.

FOREST FIRES IN KENTUCKY.

As shown by statistics gathered in the average of 15 counties annually, mostly in Eastern Kentucky for the years 1914, 1915, 1916 and spring of 1917.

(1) NO. OF FIRES.

1914	132
1915	207
1916	133
1917	111 (spring)

(2) CAUSES OF FIRES.

	1914	1915	1916	(Spring) 1917	Total	Per cent.
Lightning .....	....	1	....	1	2	0
Railroads	14	15	13	17	59	10
Lumbering	4	12	5	1	22	4
*Brush burning	23	88	46	52	209	36
Campers (hunters)	26	30	21	5	82	14
Incendiary	8	7	8	2	25	4
Miscellaneous	7	9	6	5	27	5
Unknown	50	45	34	28	157	27
	132	207	133	111	583	100

(3) LOSS BY FIRES.

	1914	1915	1916	Spring 1917
Timber destroyed (B. M.)	6,909 M. ft.	13,160 M. ft.	2,619 M. ft.	2,532 M. ft.
Value	\$26,669	\$12,477	\$13,751	\$8,477
Value of young growth destroyed	111,655	88,601	38,489	17,824
Value of improve- ments destroyed	4,469	6,347	1,667	3,494
	Acres	Acres	Acres	Acres (Spring)
	1914	1915	1916	1917
Area burned over	50,921	50,564	18,653	11,594
Open	1,632	2,939	978	2,295
Total	52,553	53,503	19,541	13,889

PURCHASE OF LAND UNDER THE WEEKS LAW.

Ever since the establishment of the State Board of Forestry the State Forester has endeavored to bring about the purchase of land by the Federal Government within the State for purposes of a National Forest. An especial effort was made after an examination was completed in the summer of 1914 and approximately 5,000 acres was recommended for purchase. The people in the Eastern part of the State where the areas were recommended for purchase were particularly anxious to see this

*Brush burning includes mostly fires set to clear off new ground and make range for stock.

brought about. The Federal Government, however, has not been willing, with the appropriation originally made for this purpose, to make additional purchase of land in new states, but has devoted the appropriation to the purpose of blocking in and completing the purchased areas in those states where the original purchases were made. The appropriation of Congress, too, for the year 1916 definitely limited the amount expended for such purposes. Before an area can be purchased in Kentucky it will be necessary that new sums be appropriated for the purchase of forest lands in additional states.

FOREST EXTENSION.

The amount of work in connection with the two State Forest Nurseries at Louisville and at Frankfort has increased very decidedly in the last two years, and the output of the nurseries in seedlings has increased in proportion. This is indicated by the sales of stock from the nurseries during the past years. In 1915 the amount of stock sold was \$3.75; in 1916 the amount of stock sold amounted to \$49.35; while the net total of the sales for the spring season of 1917 amounted to \$253.75, and enough material is already contracted for the fall season of 1917 so that the probabilities are the receipts from the nurseries for the year 1917 will be between four and five hundred dollars. The entire stock of black locust at both nurseries was sold in the spring of 1917, and additional material of this species could have been sold if it had been on hand. There is every indication that the nurseries fill a definite want in the State and that the receipts from this source will be very materially increased in the future. At the last meeting of the State Board of Forestry the distribution of trees from the State Forest Nurseries for planting along the highways was authorized by the Board under certain conditions, and it has been the endeavor in this connection to raise material suitable for highway planting. This is in line with work that is being done in other states where the planting of trees in a systematic manner along the highways has grown into an important work in proportion as the development of first class highways has taken place.

THE LOUISVILLE NURSERY.

The Louisville Nursery, as stated in the Report of 1915, is located on ground which it has been found is not especially adapted for a forest nursery. However, it was ground which seemed especially available at the time the nursery was started.

It has been necessary, therefore, to do a large amount of work in connection with building up the soil, particularly in the direction of raising green crops and turning them under. This has been a rather unlooked for expense. The area in seed and transplant beds and in the willow plantations is about five acres. The summers of 1915 and 1916 were fairly favorable ones for the raising of tree crops. Early in the spring of 1916, a hail storm of serious proportions did a lot of damage at the nursery, from the effects of which it did not recover until late in the fall. On account of the high water in the spring of 1916 it was necessary during the summer of that year to institute a system of drainage around the packing and storing house on the ground, since the water leaked into the house in such a quantity as to seriously damage the material stored there. Every effort has been made to make the surroundings at the nursery at Louisville as attractive as possible since it forms, in connection with the Federal Fish Hatchery, a permanent exhibit on the State Fair Grounds. More than anything else at the present time there is needed a team in connection with the nursery work, since this has gotten to be of such large proportions that much time is lost by hand labor where the same work could be done a great deal more expeditiously and effectively with the team. The willow plantation which was first set out in the spring of 1916 has done remarkably well. The size of the plantation was increased in the spring of 1917 by the receipt of several thousand cuttings from the plantations of the U. S. Forest Service at Arlington. The size of the plantation will be further increased in the spring of 1917 by cuttings from other sources. It is expected that rods may be cut from the plantation for commercial purposes in the spring of 1919. The amount of trees in the Louisville Nursery, and the value of that material is shown herewith.

**INVENTORY OF MATERIAL AT LOUISVILLE NURSERY
JUNE 1, 1917.**

Seed planted Fall, 1916, and Spring of 1917.

SPECIES.	NUMBER.
Black Walnut (<i>Juglans nigra</i>).....	200 lbs.
White Oak (<i>Quercus alba</i>).....	100 lbs.
Burr Oak (<i>Quercus macrocarpa</i>).....	450 lbs.
Red Oak (<i>Quercus borealis</i>).....	500 lbs.
Black Oak (<i>Quercus velutina</i>).....	100 lbs.
Cucumber Magnolia (<i>Magnolia acuminata</i>).....	5 lbs.
Sycamore (<i>Platanus occidentalis</i>).....	20 lbs.

Black Locust (<i>Robinia pseudacacia</i>).....	47 lbs.
Silver Maple (<i>Acer saccharinum</i>).....	75 lbs.
Gingko (<i>Gingko triloba</i>).....	100 lbs.

1-year-old Transplants.

SPECIES.	NUMBER.
Black Walnut (<i>Juglans nigra</i>).....	1,378
Shag Bark Hickory (<i>Hicoria ovata</i>).....	1,025
Chestnut (<i>Castanea dentata</i>).....	315
White Oak (<i>Quercus alba</i>).....	290
Red Oak (<i>Quercus borealis</i>).....	90
Black Oak (<i>Quercus velutina</i>).....	1,060
Kentucky Coffee Tree (<i>Gymocladus dioicus</i>).....	1,027
Box Elder (<i>Acer negundo</i>).....	86
White Elm (<i>Ulmus americana</i>).....	2,000
White Ash (<i>Fraxinus americana</i>).....	2,145
Blue Ash (<i>Fraxinus quadangulata</i>).....	1,685
Wild Cherry (<i>Prunus serotina</i>).....	575
Gingko (<i>Gingko triloba</i>).....	301
Apple	30

2-year-old Transplants.

SPECIES.	NUMBER.
Black Walnut (<i>Juglans nigra</i>).....	1,229
Japanese Walnut (<i>Juglans sp.</i>).....	37
Chestnut (<i>Castanea dentata</i>).....	35
Burr Oak (<i>Quercus macrocarpa</i>)	465
Pin Oak (<i>Quercus palustris</i>).....	408
Red Oak (<i>Quercus borealis</i>).....	827
Black Oak (<i>Quercus velutina</i>).....	945
Yellow Poplar (<i>Liriodendron tulipifera</i>).....	26
Kentucky Coffee Tree (<i>Gymocladus dioicus</i>).....	238
Sugar Maple (<i>Acer saccharum</i>).....	30
Silver Maple (<i>Acer saccharinum</i>).....	7,297
White Ash (<i>Fraxinus americana</i>).....	131
Gingko (<i>Gingko triloba</i>).....	143
Apricots	200

Willow Plantation—1-year-old Holt.

SPECIES.	NUMBER.
American Green (<i>Salix amygdalina</i>).....	2,500
Lemley (<i>Salix pentandra minor</i>).....	2,500
Patent Lemley (<i>Salix pentandra major</i>).....	2,000
Purple (Welsh) (<i>Salix purpurea</i>).....	2,600

Cuttings planted Spring, 1917.

American Green (<i>Salix amygdalina</i>).....	594
Purple (Welsh) (<i>Salix purpurea</i>).....	447
Americano (<i>Salix</i> ?).....	300

THE FRANKFORT NURSERY.

The Frankfort Nursery has increased in size even more than the Louisville Nursery. Since the Frankfort Nursery is located on much better ground the results in the growing of trees have been more gratifying in a great many directions than those obtained at the Louisville Nursery. It has been found in the Louisville Nursery that the planting of small seeds, such as the ash, tulip, sugar maple, elm, and some other species, cannot be done with profit, while at the Frankfort Nursery all kinds of tree seeds seem to do remarkably well. The present size of this nursery is five acres. During the spring of 1916 the amount of fence on this nursery was very considerably increased and one thing which will be done this fall will be an erection of a storehouse for the storage of seeds since it has been found in connection with the storage of seeds in the winter of 1916 and 1917 that in cold storage the seed-stock does not keep as well as it would if it were possible to store the seeds in sand. The amount of trees in the Frankfort Nursery, and the value of the material is shown herewith:

INVENTORY OF MATERIAL AT FRANKFORT NURSERY
JUNE 1, 1917.

Seed planted Fall, 1916 and Spring, 1917.

SPECIES.	AMOUNT.
Black Walnut (<i>Juglans nigra</i>).....	300 lbs.
Chestnut (<i>Castanea dentata</i>).....	12 lbs.
White Oak (<i>Quercus alba</i>).....	125 lbs.
Burr Oak (<i>Quercus macrocarpa</i>).....	25 lbs.
Chestnut Oak (<i>Quercus prinus</i>).....	350 lbs.
Chinquapin Oak (<i>Quercus acuminata</i>).....	25 lbs.
Red Oak (<i>Quercus borealis</i>).....	250 lbs.
Scarlet Oak (<i>Quercus coccinea</i>).....	20 lbs.
English Oak (<i>Quercus robur pedunculata</i>).....	12 lbs.
Cucumber (<i>Magnolia acuminata</i>).....	12 lbs.
Yellow Poplar (<i>Liriodendron tulipifera</i>).....	350 lbs.
Black Cherry (<i>Prunus serotina</i>).....	25 lbs.
Kentucky Coffee Tree (<i>Gymnocladus dioica</i>).....	12 lbs.
Black Locust (<i>Robinia pseudacacia</i>).....	20 lbs.
Water Maple (<i>Acer saccharinum</i>).....	100 lbs.

Buckeye (<i>Aesculus glabra</i>).....	100 lbs.
Horse Chestnut (<i>Aesculus hippocastanum</i>).....	12 lbs.
Gingko (<i>Gingko bilboa</i>).....	100 lbs.

1-year-old Seedlings.

SPECIES.	NUMBER.
Black Walnut (<i>Juglans nigra</i>).....	1,000
Shag Bark Hickory (<i>Hicoria ovata</i>).....	2,000
Chestnut (<i>Castanea dentata</i>).....	500
Burr Oak (<i>Quercus macrocarpa</i>).....	250
Chestnut Oak (<i>Quercus prinus</i>).....	2,300
Red Oak (<i>Quercus borealis</i>).....	3,100
Black Oak (<i>Quercus velutina</i>).....	1,000
Yellow Poplar (<i>Liriodendron tulipifera</i>).....	3,000
Kentucky Coffee Tree (<i>Gymnocladus dioicus</i>).....	500
Yellow-wood (<i>Cladrastis lutea</i>).....	400
Black Locust (<i>Robinia pseudacacia</i>).....	3,000
Water Maple (<i>Acer saccharinum</i>).....	9,000
Blue Ash (<i>Fraxinus quadrangulata</i>).....	300
Gingko (<i>Gingko bilboa</i>).....	250

1-year-old Transplants.

SPECIES.	NUMBER.
Yellow Pine (<i>Pinus echinata</i>).....	1,000
Red Cedar (<i>Juniperus virginia</i>).....	500
Black Walnut (<i>Juglans nigra</i>).....	550
White Oak (<i>Quercus alba</i>).....	1,000
Yellow Poplar (<i>Liriodendron tulipifera</i>).....	1,000
Kentucky Coffee Tree (<i>Gymnocladus dioicus</i>).....	100
Black Locust (<i>Robinia pseudacacia</i>).....	25,000
Sugar Maple (<i>Acer saccharum</i>).....	21,000
Box Elder (<i>Acer negundo</i>).....	100
American Linden (<i>Tilia americana</i>).....	1,000
White Ash (<i>Fraxinus americana</i>).....	1,000
Catalpa (<i>Catalpa speciosa</i>).....	500

SEEDS.

As was anticipated in the previous report the chief source of supply for the Frankfort and Louisville Nurseries has been within the State and each fall a large amount of seed has been gathered in the various portions of the State. This will be done in the fall of 1917 as heretofore and the arrangements have been made for a large gathering of an unusually large supply and the storage of this supply during the winter months. Not only has it been found advisable and possible to gather the seeds in the state but the office of the State Forester has found that there is a large

demand for tree seed material from within and without Kentucky which may be supplied through his office at a profit. This year there were sold over 100 bushels of tree seed which were gathered through the office of the State Forester and it is expected that the amount of tree seed material to be disposed of this year will exceed this amount.

EXPERIMENTAL FOREST.

The experimental forest at the rear of the Louisville Nursery along the Ohio River has done very well and the trees begin to show up in a satisfactory manner. Additional trees are planted from time to time and eventually the forest is going to form one of the attractive features around the nursery, and it will furnish as well an opportunity for demonstrating what can be done in Kentucky with a permanent woodlot in the way of raising various kinds of woodlot material.

LIBRARY.

The amount of material in the library in the office of the State Forester relating to forestry and kindred subjects has been very materially increased in the last few years by the addition of reports of the various states, the Dominion of Canada and the Federal Government and from contributions from other sources which have been supplied without expense to the office of the State Forester. It is safe to say that the collection of forestry material in the office of the State Forester at the present time constitutes quite the best library on the subject of forestry anywhere in the State, and this material has been found of great value in several directions by individuals who have been anxious to obtain information along these lines.

WOOD COLLECTION AND EXHIBIT.

Through the interest of the Rev. J. T. McGlothlin, of Frankfort, Mrs. Dorinda Duncan, of Franklin, Ky., was kind enough to present to the State Board of Forestry a collection of woods made by her late husband, Dr. Geo. W. Duncan. This collection consists of sixty-two native woods and the blocks have been shaped in the form of books. It is proposed to add to this collection to include all the native woods in the State.

REPORT OF THE STATE FORESTER.

FINANCIAL STATEMENT.

FISCAL YEAR 1916.

Beginning July 1, 1915, and Ending June 30, 1916.

Appropriation	\$15,000.00
Receipts	13.85
<hr/>	
Total amount available	\$15,013.85
Total expenditures	15,011.13
<hr/>	
Balance 6/30/16	\$2.72

STANDARDIZED DISTRIBUTION OF EXPENDITURES OF THE
OFFICE OF THE STATE FORESTER FOR
FISCAL YEAR 1916.

Beginning July 1, 1915, and Ending June 30, 1916.

1. Salaries—		
Fire protection	\$2,775.00	
Nursery	1,725.00	
Misc. Exec.	4,299.96	
	<hr/>	\$8,799.96
2. Wages—		
Fire protection	\$2,253.68	
Nursery	209.90	
	<hr/>	2,463.58
3. Traveling expenses—		
Fire protection	\$520.56	
Misc. Exec.	530.65	
	<hr/>	1,051.21
4. Transportation of materials		59.75
5. Subsistence—		
6. Communication		301.91
7. Advertising, printing and binding—		
Fire protection	\$119.03	
Misc. Exec.	1,628.09	
	<hr/>	1,747.12
8. Equipment: Office		128.00
9. Equipment: Field—		
Fire protection	\$0.80	
Nursery	379.30	
	<hr/>	380.10
10. Miscellaneous—		
Nursery	\$33.00	
Misc. Exec.	46.50	
	<hr/>	79.50
<hr/>		
Grand total		\$15,011.13

DETAILED EXPENDITURES AT STATE FOREST NURSERY, FRANKFORT, KY.

Fiscal Year 1916.

Labor		\$9.90
Freight, hauling, etc.....		6.63
Tools, equipment, etc.....		3.00
Materials—		
Seed	\$18.65	
Other	26.00	
		<hr/> 44.65
Plowing		2.00
Construction		15.00
Salaries		825.00
		<hr/> \$966.18

DETAILED EXPENDITURES AT STATE FOREST NURSERY LOUISVILLE, KY.

Fiscal Year 1916.

Labor		\$141.75
Freight, hauling, etc.....		32.25
Tools, equipment, etc.....		43.31
Materials—		
Seed	\$149.99	
Other	99.00	
		<hr/> 248.99
Plowing		56.25
Construction		33.00
Salaries		900.00
		<hr/> \$1,455.55

STATEMENT OF RECEIPTS AND EXPENDITURES OF THE STATE BOARD OF FORESTRY FOR FISCAL YEAR 1916.

Beginning July 1, 1915, and ending June 30, 1916.

1915		
7/1	J. E. Barton, et al.....	\$583.33
7/1	G. R. Hughes (stamps).....	25.00
7/1	Belknap Hdwe. Co.....	6.00
7/1	Underwood Typewriter Co.....	35.00
7/1	Central Clipping Bureau.....	2.50
7/1	Kellie Beshears, et al.....	482.00
7/1	L. Boyd Wear.....	104.00
7/1	J. E. Barton (expenses).....	66.94
7/1	Wood, Stubbs & Co.....	26.14
		<hr/> \$1,330.91

7/1	James M. Bloomfield, et al.....	\$32.40	\$1,363.31
7/1	Wilson Browning, Jr., et al.....	28.43	1,391.74
7/1	Henry Towery (expenses).....	30.15	1,421.89
7/1	Laib Co.	5.73	1,427.62
7/1	F. W. Kelsey Nursery Co.....	24.55	1,452.17
7/1	Bert McKinney .....	.80	1,452.97
7/1	H. F. Price (expenses).....	51.12	1,504.09
7/2	Frank Kleber	31.50	1,535.59
7/2	T. E. Cornell.....	47.25	1,582.84
7/2	Martin Amon	10.59	1,593.34
7/3	Albrecht Sons Hardware Co.....	8.50	1,601.84
7/3	Frankfort Home Tel. & Teleg. Co.....	2.50	1,604.34
7/3	Cumberland Tel. & Teleg. Co.....	3.80	1,608.14
7/22	J. E. Barton (expenses).....	30.35	1,638.49
7/23	Harry Jones (expenses).....	26.31	1,664.80
7/31	J. E. Barton (expenses).....	24.53	1,689.33
7/31	J. E. Barton, et al.....	808.33	2,497.66
8/2	Henry Towery (expenses).....	7.09	2,504.75
8/2	H. A. Gretter.....	7.00	2,511.75
8/2	F. W. Kelsey Nursery Co.....	14.90	2,526.65
8/2	Laib Company	5.10	2,531.75
8/3	T. E. Cornell.....	13.50	2,545.25
8/3	Frank Kleber	4.50	2,549.75
8/3	Al Piers	12.00	2,561.75
8/3	Frankfort Home Tel. & Teleg. Co.....	2.50	2,564.25
8/4	Cumberland Tel. & Teleg. Co.....	3.47	2,567.72
8/4	A. B. Dick Co.....	35.00	2,602.72
8/7	J. E. Barton (expenses).....	17.00	2,619.72
8/7	Laib Company	11.63	2,631.35
8/7	Laib Company	7.20	2,638.55
8/11	Louis Oestreich	30.00	2,668.55
8/11	State Journal (Nat. Branch Bk.).....	30.64	2,699.19
8/18	J. E. Barton (expenses).....	34.10	2,733.29
8/26	Western Newspaper Union	96.00	2,829.29
8/26	J. E. Barton (expenses)	35.45	2,864.74
8/27	Saunders' Express	3.00	2,867.74
8/30	Laib Company	27.50	2,895.24
8/31	J. E. Barton, et al.....	808.33	3,703.57
9/2	Cumberland Tel. & Teleg. Co.	7.40	3,710.97
9/2	Frankfort Home Tel. Co.	2.50	3,713.47
9/2	Central Clipping Bureau	5.00	3,718.47
9/2	Albrecht Sons Hdwe. Co.	2.80	3,721.27
9/2	Wood, Stubbs & Co.	2.50	3,723.77
9/2	L. W. Hancock Co.....	33.00	3,756.77
9/7	Harry Jones (expenses)	38.90	3,795.67
9/9	Clay County Clarion	3.75	3,799.42
9/9	J. E. Barton (expenses)	27.20	3,826.62

9/10	Wood, Stubbs & Co.	\$4.00	\$3,830.62
9/20	American Press Association	98.20	3,928.82
9/20	J. E. Barton (expenses)	23.52	3,952.34
9/21	Horn Transfer Line	3.50	3,955.84
9/21	Louise Crabtree	12.65	3,968.49
9/21	Kentucky Nursery Company	10.00	3,978.49
9/30	J. E. Barton, et al.	808.33	4,786.82
10/1	G. R. Hughes (stamps)	25.00	4,811.82
10/2	J. S. Arnett, et al.	100.00	4,911.82
10/2	Central Clipping Bureau	2.50	4,914.32
10/5	Horn Transfer Line	15.92	4,930.24
10/6	State Journal	115.28	5,045.52
10/8	Cumberland Tel. & Teleg. Co.	3.10	5,048.62
10/8	J. E. Barton (expenses)	27.96	5,076.58
10/8	Frankfort Home Tel. & Teleg. Co.	2.50	5,079.08
10/8	T. E. Cornell	33.75	5,112.83
10/9	Capitol Lumber & Mfg. Co.	41.00	5,153.83
10/16	G. R. Hughes (Stamps)	25.00	5,178.83
10/16	Harry Jones (expenses)	37.49	5,216.32
10/16	J. E. Barton (expenses)	24.21	5,240.53
10/25	Hall Seed Company	71.50	5,312.03
10/31	J. E. Barton, et al.	808.33	6,120.36
11/2	J. E. Arnett, et al. (pay roll)	654.00	6,774.36
11/2	Cumberland Tel. & Teleg. Co.	4.30	6,778.66
11/2	B. R. Bacon Hdwe. Co.	18.70	6,797.36
11/3	Harry Jones (expenses)	49.55	6,846.91
11/5	Moritz Martin	9.90	6,856.81
11/5	Frankfort Home Tel. & Teleg. Co.	2.75	6,859.56
11/6	State Journal	13.70	6,873.26
11/8	J. E. Barton (expenses)	20.71	6,893.97
11/10	Central Clipping Bureau	2.50	6,896.47
11/18	J. E. Barton (expenses)	10.10	6,906.57
11/19	R. W. James	2.00	6,908.57
11/19	Sarah Webb Maury (expenses)	4.25	6,912.82
11/19	Allo Carrico	10.60	6,923.42
11/20	W. H. Mackoy (expenses)	9.40	6,932.82
11/23	Harry Jones (expenses)	49.13	6,981.95
11/23	H. F. Price (expenses)	25.63	7,007.58
11/23	Everett Blair, et al. (pay roll)	57.50	7,065.08
11/24	Martin Amon	3.00	7,068.08
11/24	Gus Beeser	1.50	7,069.58
11/24	Frank Kleber	22.50	7,092.08
11/30	J. E. Barton, et al.	808.33	7,900.41
12/1	Frankfort Transfer Co.	2.00	7,902.41
12/1	Central Clipping Bureau	2.50	7,904.91
12/1	L. & N. Ry. Company	2.77	7,907.68
12/1	Frankfort Home Tel. & Teleg. Co.	2.50	7,910.18

12/2	Albrecht Sons Hardware Co.	\$1.60	\$7,911.78
12/2	B. R. Bacon Hdwe. Co.	3.00	7,914.78
12/3	State Journal Company	86.32	8,001.10
12/3	Cumberland Tel. & Teleg. Co.	9.48	8,010.58
12/3	Henry Towery	4.72	8,015.30
12/8	J. S. Arnett, et al.	770.00	8,785.30
12/8	H. F. Price	21.50	8,806.80
12/11	Merchants' Transfer & Storage Co.	14.45	8,821.25
12/11	Frank Brown, et al.	25.35	8,846.60
12/15	Harry Jones	38.20	8,884.80
12/17	C. D. Arnett, et al.	770.83	9,655.63
1916			
1/4	F. W. Kelsey Nursery Company.....	18.65	9,674.28
1/4	Cumberland Tel. & Teleg. Co.	4.40	9,678.68
1/7	Geo. G. Fetter Co.	12.45	9,691.13
1/10	G. R. Hughes (stamps)	50.00	9,741.13
1/11	Central Clipping Bureau	2.50	9,743.63
1/12	State Journal Co.	72.30	9,815.93
1/12	Frankfort Home Tel. & Teleg. Co.....	2.50	9,818.43
1/17	Shenandoah Nurseries	16.45	9,834.88
1/17	Harry Jones (expenses)	33.51	9,868.39
1/19	J. E. Barton (expenses)	8.65	9,877.04
1/26	J. E. Barton, et al.....	658.33	10,535.37
2/2	Adams Express Co.	1.86	10,537.23
2/3	State Journal Co.	1,224.82	11,762.05
2/4	Cumberland Tel. & Teleg. Co.	3.96	11,766.01
2/7	J. E. Barton (expenses)	16.10	11,782.11
2/10	Frankfort Home Tel. & Teleg. Co.	2.50	11,784.61
2/21	Harry Jones	26.82	11,811.43
2/24	J. E. Barton, et al.....	658.33	12,469.76
3/1	G. R. Hughes (stamps)	50.00	12,519.76
3/1	Donaldson Co.	10.50	12,530.26
3/4	Chas. E. Pitzinger	35.00	12,565.26
3/4	Cumberland Tel. & Teleg. Co.	4.65	12,569.91
3/9	Frankfort Home Tel. & Teleg. Co.....	2.50	12,572.41
3/9	State Journal Co.	1.25	12,573.66
3/10	J. E. Barton (expenses)	15.50	12,589.16
3/16	Albrecht Sons Hdwe. Co. ....	.75	12,589.91
3/25	J. E. Barton, et al.....	658.33	13,248.24
4/3	J. E. Barton (expenses)	32.15	13,280.39
4/3	G. R. Hughes (stamps)	25.00	13,305.39
4/3	Cumberland Tel. & Teleg. Co.	3.30	13,308.69
4/4	H. F. Price	10.70	13,319.39
4/5	Harry Jones	17.75	13,337.14
4/6	Frankfort Home Tel. & Teleg. Co.....	2.50	13,339.64
4/11	G. G. Fetter Co.	45.55	13,385.19
4/24	J. E. Barton (expenses)	19.21	13,404.40

REPORT OF THE STATE FORESTER.

19

4/25	J. E. Barton, et al.....	\$695.83	\$14,100.23
5/3	State Journal Co.	4.86	14,105.09
5/3	H. F. Price	32.21	14,137.30
5/3	Cumberland Tel. & Teleg. Co.	3.80	14,141.10
5/3	Woodson May	19.78	14,160.88
5/8	J. E. Barton (expenses)	33.60	14,194.48
5/15	J. E. Barton (expenses)	23.05	14,217.53
5/16	Louise Crabtree	40.00	14,257.53
5/25	J. E. Barton, et al.	693.33	14,950.86
6/7	J. E. Barton (expenses)	14.02	14,964.88
6/17	G. R. Hughes (stamps)	25.00	14,989.88
6/21	Forest Nursery & Seed Co.	5.00	14,994.88
6/21	Iring Transfer Co.	16.25	15,011.13

FISCAL YEAR 1917.

Beginning July 1, 1916, and ending June 30, 1917.

Appropriation	\$15,000.00
Additional credit	1,173.23
Receipts	302.48
<hr/>	
Total amount available	\$16,475.71
Total expenditures	16,473.11
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Balance 6/30/17	\$2.60

STATEMENT OF RECEIPTS OFFICE OF STATE FORESTER.

Fiscal Years 1915, 1916, 1917.

The receipts are entirely from the sales of seeds and seedlings from the State Forest Nurseries.

Fiscal year 1915	\$ 3.75
Fiscal year 1916	13.85
Fiscal year 1917	302.48

STANDARDIZED DISTRIBUTION OF EXPENDITURES OF THE OFFICE OF THE STATE FORESTER FOR FISCAL YEAR 1917.

Beginning July 1, 1916, and ending June 30, 1917.

1. Salaries—		
Fire protection	\$4,955.00	
Nurseries	1,950.00	
Misc. Exec.	3,773.37	
	<hr/>	\$10,678.37
2. Wages—		
Fire protection	\$2,942.74	
Nurseries	398.66	
Misc. Exec.	5.00	
	<hr/>	3,346.40

REPORT OF THE STATE FORESTER.

3. Traveling expenses—		
Fire protection	\$648.81	
Misc. Exec.	692.22	
		\$1,341.03
4. Transportation of materials—		
Nursery	\$91.47	
Misc. Exec. ....	.75	
		92.22
5. Subsistence		9.25
6. Communication		220.83
7. Advertising, printing and binding—		
Fire protection	\$35.62	
Misc. Exec.	77.80	
		113.42
8. Equipment: Office		2.45
9. Equipment: Field		14.30
10. Materials and supplies: Office		120.24
11. Materials and supplies: Field		483.65
12. Miscellaneous—		
Nurseries	\$43.95	
Misc. Exec.	7.00	
		50.95
Grand total		\$16,473.11

**STATEMENT OF RECEIPTS AND EXPENDITURES OF THE
STATE BOARD OF FORESTRY FOR
FISCAL YEAR 1917.**

Beginning July 1, 1916, and ending June 30, 1917.

1916		
7/1	Adams Express Company	\$0.66 \$0.66
7/1	Frankfort Home Tel. & Teleg. Co.	2.50 3.16
7/1	Cumberland Tel. & Teleg. Co.	4.50 7.66
7/1	Frankfort Home Tel. & Teleg. Co.	5.00 12.66
7/1	The Donaldson Co.	8.00 20.66
7/1	B. R. Bacon Hdwe. Co.	1.65 22.31
7/1	Martin Amon	13.50 35.81
7/1	Gus Beeser	3.75 39.56
7/1	Frank Kleber	7.50 47.06
7/1	T. E. Cornell	20.25 67.31
7/1	F. W. Kelsey Nursery Co.	32.85 100.16
7/1	C. D. Arnett	75.00 175.16
7/1	H. F. Price	25.01 200.17
7/1	H. F. Price	12.15 212.32
7/1	Woodson May	27.30 239.62
7/1	J. S. Arnett, et al.	480.00 719.62
7/1	J. S. Arnett, et al.	372.00 1,091.62

7/1	C. D. Arnett, et al.....	\$808.37	\$1,899.99
7/1	Cleve Farmer, et al.	36.65	1,936.64
7/3	R. A. Brawner .....	.75	1,937.39
7/3	Adams Express Co.	1.64	1,939.03
7/3	Cumberland Tel. & Teleg. Co.	2.75	1,941.78
7/3	J. E. Barton (expenses)	37.80	1,979.58
7/10	State Journal Co.	4.30	1,983.88
7/18	J. E. Barton (expenses)	67.35	2,051.23
7/31	C. D. Arnett, et al.	808.33	2,859.56
8/2	State Journal Co.	1.70	2,861.26
8/3	Cumberland Tel. & Teleg. Co.	2.75	2,864.01
8/3	H. F. Price (expenses)	13.05	2,877.06
8/3	Woodson May (expenses)	21.45	2,898.51
8/4	J. E. Barton (expenses)	28.50	2,927.01
8/10	A. Bartels	15.75	2,942.76
8/10	Albrecht Sons Hdwe. Co.	5.50	2,948.26
8/10	Albrecht Sons Hdwe. Co.	12.10	2,960.36
8/14	J. E. Barton (expenses)	22.86	2,983.22
8/21	J. E. Barton (expenses)	23.70	3,006.92
8/29	Iring Transfer Co.	13.06	3,019.98
8/29	O. A. Holbrook, et al.	28.00	3,047.98
8/31	Chas. D. Arnett, et al.	833.33	3,881.31
9/1	Marion McClarthy	4.50	3,885.81
9/1	Frank Kleber	6.66	3,892.47
9/1	T. E. Cornell	4.50	3,896.97
9/1	Frankfort Home Tel. & Teleg. Co.	5.00	3,901.97
9/1	Martin Amon	3.00	3,904.97
9/7	Cumberland Tel. & Teleg. Co.	3.90	3,908.87
9/7	J. E. Barton (expenses)	59.74	3,968.61
9/8	Woodson May (expenses)	7.10	3,975.71
9/8	Sarah Webb Maury (expenses)	4.75	3,980.46
9/8	Geo. G. Fetter Co.	18.35	3,998.81
9/8	John Crawford	70.00	4,068.81
9/8	John Crawford	18.25	4,087.06
9/13	Albrecht Sons Hdwe. Co.	2.10	4,089.16
9/13	Mart O'Brien	20.25	4,109.41
9/18	J. E. Barton (expenses)	14.45	4,123.86
9/18	W. H. Mackoy (expenses)	7.70	4,131.56
9/25	J. E. Barton (expenses)	20.10	4,151.66
9/25	G. R. Hughes (stamps)	25.00	4,176.66
9/25	Chas. D. Arnett, et al.....	833.33	5,009.99
10/2	Lewis S. Chilton, et al.....	100.00	5,109.99
10/2	Woodson May	22.30	5,132.29
10/2	State Journal Co.	31.31	5,163.60
10/3	H. A. Gretter	10.00	5,173.60
10/4	Cumberland Tel. & Teleg. Co.	3.55	5,177.15
10/5	Frankfort Home Tel. & Teleg. Co.	2.50	5,179.65

10/9	Reid Bros.	\$2.35	\$5,182.00
10/9	Wm. Roach	27.50	5,209.50
10/13	J. E. Barton (expenses)	31.38	5,240.88
10/14	Louisville Hay & Grain Co.	10.05	5,250.93
10/21	J. E. Barton (expenses)	10.35	5,261.28
10/23	Chas. D. Arnett, et al.	833.33	6,094.61
10/24	M. B. Whitt	6.00	6,100.61
11/2	Woodson May (expenses)	14.73	6,115.34
11/6	Cumberland Tel. & Teleg. Co.	3.13	6,118.47
11/6	Frankfort Home Tel. & Teleg. Co.	2.50	6,120.97
11/7	G. R. Hughes (stamps)	25.00	6,145.97
11/9	J. E. Barton (expenses)	24.51	6,170.48
11/9	J. S. Arnett, et al.	576.00	6,746.48
11/10	State Journal Co.	30.67	6,777.15
11/13	A. Zappone	1.00	6,778.15
11/20	J. E. Barton (expenses)	21.06	6,799.21
11/20	Geo. G. Fetter & Co.	4.20	6,803.41
11/21	H. F. Price (expenses)	12.80	6,816.21
11/21	Edw. Martin, et al.	27.50	6,843.71
11/21	Consolidation Coal Co.	15.37	6,859.08
11/21	Moritz Martin	10.00	6,869.08
11/24	John Crawford	35.25	6,904.33
11/24	C. D. Arnett, et al.	833.33	7,737.66
11/29	J. S. Arnett, et al.	520.00	8,257.66
12/1	A. C. Bailey, et al.	36.80	8,294.46
12/1	H. H. Hansborough	63.81	8,358.27
12/1	L. & N. R. R. Co.	8.78	8,367.05
12/1	Albrecht Sons Hdwe. Co.	2.25	8,369.30
12/2	Woodson May	26.90	8,396.20
12/4	Cumberland Tel. & Teleg. Co.	4.02	8,400.22
12/4	Frankfort Home Tel. & Teleg. Co.	2.75	8,402.97
12/11	J. E. Barton (expenses)	32.14	8,435.11
12/11	Frankfort Transfer Co.	4.50	8,439.61
12/16	Chas. D. Arnett, et al.	833.33	9,272.94
1917			
1/3	Frankfort Home Tel. & Teleg. Co.	2.50	9,275.44
1/3	Cumberland Tel. & Teleg. Co.	6.01	9,281.45
1/5	Lewis S. Chilton	16.00	9,297.45
1/5	J. E. Barton (expenses)	44.74	9,342.19
1/5	Allo Carrico	10.00	9,352.19
1/5	Woodson May (expenses)	10.55	9,362.74
1/23	Chas. D. Arnett, et al.	833.33	10,196.07
2/1	Frankfort Ice Co.	3.30	10,199.37
2/1	L. & N. R. R. Co.	20.90	10,220.27
2/1	Ralph Glenn	14.12	10,234.39
2/1	Forest Nursery & Seed Co.	4.38	10,238.77
2/1	Donaldson Co.	104.00	10,342.77

2/1	H. A. Gretter	\$6.00	\$10,348.77
2/1	J. E. Barton (expenses)	98.85	10,447.62
2/1	G. R. Hughes, P. M. (stamps)	25.00	10,472.62
2/2	R. A. Brawner	1.25	10,473.87
2/3	Cumberland Tel. & Teleg. Co.	8.73	10,482.60
2/3	Frankfort Home Tel. & Teleg. Co.	2.50	10,485.10
2/3	Elijah Amburgy	25.00	10,510.10
2/6	Geo. G. Fetter Co.	21.25	10,531.35
2/7	Harcourt & Co.	45.00	10,576.35
2/20	Chas. D. Arnett, et al.	790.83	11,367.18
3/2	Frankfort Home Tel. & Teleg. Co.	2.50	11,369.68
3/2	Cumberland Tel. & Teleg. Co.	4.51	11,374.19
3/2	Frankfort Ice Company	5.70	11,379.89
3/3	H. F. Price (expenses)	14.15	11,394.04
3/5	J. E. Barton (expenses)	66.27	11,460.31
3/23	J. E. Barton, et al.	758.33	12,218.64
4/2	Capital Lbr. & Mfg. Co.	51.23	12,269.87
4/2	The Donaldson Nursery Company.....	11.25	12,281.12
4/2	Forest Nursery & Seed Co.	14.80	12,295.92
4/2	Albrecht Sons Hdwe. Co.	2.15	12,298.07
4/2	Jos. N. Zoeller	24.87	12,322.94
4/2	Laib Company .....	.70	12,323.64
4/2	Henry Koehler & Co.	26.30	12,349.94
4/3	Woodson May (expenses)	11.25	12,361.19
4/4	Frankfort Home Tel. & Teleg. Co.	2.50	12,363.69
4/4	R. A. Brawner	6.00	12,369.69
4/4	B. R. Bacon Hdwe. Co.	79.60	12,449.29
4/4	Cumberland Tel. & Teleg. Co.	6.15	12,455.44
4/4	State Journal Company	21.88	12,477.32
4/4	National Map Co.	2.45	12,479.77
4/5	G. R. Hughes, P. M. (stamps)	25.00	12,504.77
4/9	J. E. Barton (expenses)	57.84	12,562.61
4/21	J. E. Barton (expenses)	31.39	12,594.00
4/24	J. E. Barton, et al.	758.33	13,352.33
5/2	Woodson May (expenses)	52.33	13,404.66
5/2	Chas. D. Arnett	12.50	13,417.16
5/3	Merchants Ice & Cold Storage Co.	1.70	13,418.86
5/3	H. D. Hackett & Co.	10.00	13,428.86
5/3	Frankfort Home Tel. & Teleg. Co.	2.50	13,431.36
5/3	Cumberland Tel. & Teleg. Co.	11.27	13,442.63
5/4	Louisville Hay & Grain Co.	7.35	13,449.98
5/4	Lewis S. Chilton, et al.	430.00	13,879.98
5/4	Mart O'Brien	34.75	13,914.73
5/4	John Ball, et al.	20.40	13,935.13
5/7	J. E. Barton (expenses)	31.39	13,966.52
5/7	Harry F. Price (expenses)	71.30	14,037.82
5/7	Dave Haley	62.00	14,099.82

5/7	Ottie Hall	\$28.00	\$14,127.82
5/7	Capital Lumber & Mfg. Co.	17.50	14,145.32
5/7	R. A. Brawner	1.00	14,146.32
5/7	Barteldes Seed Co.	4.60	14,150.92
5/7	Iring Transfer Co.	11.74	14,162.66
5/7	Edward Wathen	1.25	14,163.91
5/7	John Crawford	43.00	14,206.91
5/7	State Journal Co.	9.65	14,216.56
5/15	J. E. Barton (expenses)	29.34	14,245.90
5/24	Chas. D. Arnett, et al.	833.33	15,079.23
6/2	John E. Kane	12.00	15,091.23
6/2	Frank Blanton, et al.	32.60	15,123.83
6/2	Adams Express Co.	2.92	15,126.75
6/2	David Haley	60.00	15,186.75
6/2	L. & N. R. R. Co.	2.02	15,188.77
6/3	R. A. Brawner	2.00	15,190.77
6/3	Frankfort Home Tel. & Teleg. Co.	2.50	15,193.27
6/3	Cumberland Tel. & Teleg. Co.	4.06	15,197.33
6/4	H. F. Price (expenses)	36.20	15,233.53
6/4	Woodson May	35.34	15,268.87
6/5	Geo. G. Fetter & Co.	31.44	15,300.31
6/7	Sol. Hall, et al.	11.67	15,311.98
6/7	J. E. Barton (expenses)	62.10	15,374.08
6/8	State Journal Co.	13.91	15,387.99
6/18	John Fehr	12.00	15,399.99
6/20	F. W. Kelsey Nursery Co.	20.60	15,420.59
6/20	T. E. Cornell	5.00	15,425.59
6/20	The Donaldson Co.	49.20	15,474.79
6/20	B. R. Bacon Hdwe. Co.	1.45	15,476.24
6/20	John Crawford	18.25	15,494.49
6/20	Dave Haley	60.00	15,554.49
6/20	Frankfort Home Tel. & Teleg. Co.	2.50	15,556.99
6/24	Chas. D. Arnett, et al.	833.37	16,390.36
6/27	Cumberland Tel. & Teleg. Co.	2.75	16,393.11
6/29	J. E. Barton (expenses)	35.00	16,428.11
6/29	G. R. Hughes (stamps)	15.00	16,443.11
6/29	John Butler, et al.	30.00	16,473.11

EXPENDITURES UNDER THE WEEKS LAW.

The agreement between the Federal Government under the Weeks Law became effective October, 1913. Expenditures under this agreement are made according to the calendar year and must be made entirely for the salaries of patrolmen and lookout watchmen in accordance with the terms of the agreement. The expenditures to date are as follows:

Calendar year 1913 (approximately 3 months).....	\$1,068.00
Calendar year 1914.....	3,944.00
Calendar year 1915.....	3,410.50
Calendar year 1916.....	3,703.69
Calendar year 1917 (to 6/30/17).....	727.34

FOREST TAXATION IN THE UNITED STATES.

Address before the Kentucky Academy of Science May 5th, 1917.

J. E. BARTON,

State Forester of Kentucky.

At the present time there is no question entering into the practice of forestry in the United States of more importance than forest taxation, and yet it is a question which has in the main received scant consideration. Only a few states have undertaken to deal with the matter. Of course the problem, so far as the Federal Government is concerned, is already solved by the fact that no taxes accrue on the Federal owned lands included within the National Forests. But as relates to the individual states and particularly in view of the fact that the large bulk of the forest property of the United States is in the hands of private owners the question of forest taxation looms as second in importance only to the question of protection from forest fires. The question of forest fires deals with the physical preservation of present and prospective forest growth. The question of forest taxation deals with the financial possibility for the continuity of the forest growth and its disposal in the future. The raising of forest crops is a long time investment with low interest and as such must recommend itself because of the stability of the factors which enter into the investment and the security of the money so invested. This favorable condition does not exist under the present system of forest taxation where the assessment of forest lands and the timber thereon is purely local, so that the handling of matters of assessment and taxation in any community is in the hands of relatively few men who have no broad knowledge of timber and timber conditions. Timber is the only crop which is taxed as such. *"By failure to recognize that the growth produced is a crop, distinct from the land, grown at the owner's effort and expense, and returning no revenue until ripe, the law now compels the repeated annual taxation of the owner's effort to an extent very likely to amount to confiscation."

*E. T. Allen in "Practical Forestry in the Pacific Northwest," p. 115.

The history of the lumber industry through a considerable period of years in the past shows that the price of lumber to the consumer has continued to rise. Recent investigations on the part of the federal government show that this rise is due in a large part to the increasing share which transportation charges play in the ultimate market price of the timber. At the present time transportation charges represent about one-fifth of the entire amount of the price to the consumer. Timber is chiefly valuable as a construction material because of its adaptability and its cheapness. In order that timber may continue to remain cheap it will be necessary to have available nearby supplies of timber so that the transportation charges are very materially reduced. This last condition can not, however, be brought about unless the question of raising timber (which is a long time investment with low rates of interest, as has been shown above) is made reasonably stable and safe. For years in the past the amount of taxation on forest lands, whether such lands supported mature timber or young growth, was very small indeed—so small, in fact, that the matter of taxation had little bearing on the problem. But within recent years, with the increasing burden of taxation due to various causes, the forest lands have been subjected to materially increased taxes, since it was held, and rightly in a large number of cases, that the value of the timber on the tracts had enormously enhanced. The increase in taxation so far as forest lands are concerned was a measure designed to deal with the mature timber already on the ground—timber in which the cost of planting and subsequent care and management had played no part. It did not, however, take into consideration fluctuating market conditions and the desirability of holding timber lands (especially cut-over lands) in the future for the production of further forest crops. Neither did it discriminate between mature timber and young growth which did not reach maturity for a considerable period of years. Nor, moreover, did it distinguish between forests naturally produced and those artificially planted. In a large number of states where large bodies of timber were owned by foreign corporations the taxing of timber lands became a pleasant pastime in the individual counties, since it offered an easy way to secure revenue, and had no political back-fire. The result of this has been that there has been a strong tendency on the part of timber owners to cut timber and place it on the market whether the market conditions justified the cutting or not. And a further evil result, even more serious than the inopportune cutting of mature timber, has been that no reforestation

or afforestation of areas manifestly suitable to timber growth has been attempted for the reason that the taxes on the land, even after the mature timber was cut, were based upon an area stocked with marketable, mature timber. Another unfortunate condition which has followed in the train of this excessive taxation has been that no forest protection has been attempted on cut-over lands, except in widely scattered instances. However, recently it has been recognized that there is a strong economic reason for maintaining in forest growth areas not suited to agriculture and for this reason the study of the tax question with relation to the production of a timber crop has been investigated from several points of view.

There are two angles from which forest taxation may be approached. One is the placing of high taxation on a given piece of land as a penalty for failure to provide adequate reforestation and forest management upon the tract under consideration. The other angle is a relatively lower taxation as a bonus for the production of a timber crop and the caring for this crop until maturity. The first proposition—that of placing high taxation on a piece of land as a penalty for failure to provide reforestation—is not one which recommends itself and has never been satisfactory in practice, so far as I know. The other angle is a relatively lower taxation as a bonus for the production of a timber crop and the caring for this crop until maturity. This last proposition is incorporated in the present laws of several states in two ways. In one method a considerable bonus is offered by the state or government for the maintenance of land in forest growth and the proper management of such growth. This procedure is adopted in the state law of Minnesota, for instance. The other idea is that which is finding most favor among the foresters of the country at the present time. It embraces the dictum that forest land must be taxed on an equitable basis with other property. For this reason it has of late years become a generally accepted theory among experts on forest land taxation that there is only one fair method of taxation which may be applied to land maintained by the owner in forest growth. This theory holds that there should be a tax on the land separate from the timber which shall be a fixed annual tax and that the tax upon the timber shall be collected at maturity when the timber is harvested in the form of a certain percentage of the marketable value of the timber crop. These ideas have been incorporated in one form or another in the laws of several states. The essentials of these laws are the following features: (1) the classi-

fication of land as forest land or otherwise; (2) an agreement with the state to maintain forest land in forest growth for a definite period of years, and penalties for failure to carry out the agreement; (3) assessment of the land at a certain amount or rate per acre, which shall be a fixed annual tax on the land during the entire period for which the contract with the state calls; (4) assessment on the timber in the form of certain per cent. of the value of the forest crop when it is harvested, this per cent. to be distributed among the proper county, state or school funds; (5) fixed charges to meet other taxes which may be considered necessary. If a code of taxation laws with relation to forest property embodying these features were put into effect there is no reason why the continuity of timber growth and consequently of a forest crop should not be assured.

The question of forest taxation has been dealt with specifically in the following states: Massachusetts, Wyoming, Louisiana, Minnesota, New York, Pennsylvania, Vermont, Connecticut and Michigan. Probably the most complete laws dealing with the subject and in many ways the simplest, are those of Pennsylvania. They may be taken in this respect as models. These involve the best theoretical principles of forest taxation without a large amount of burdensome details. The laws of Massachusetts are extensive, but decidedly involved. The features of the tax laws of the various states are herewith briefly set forth:

Wyoming provides bounties for forest tree culture; prescribes method of planting and time trees shall be kept alive before bounty is payable. Proof of compliance with the law necessary.

Wisconsin exempts forest plantations from taxation for thirty years; prescribes size of plantation and number of trees per acre. Land to be used for forest plantation must not be valued for less than \$10 per acre. Thinning to half the number of trees permitted after 10 years.

Louisiana provides for reforestation of land valued at less than \$5 per acre; prescribes character of planting and details of forest management, period for management from thirty to forty years. Fixed valuation on land planted to trees at \$1 per acre. The valuation remains during the life of the contract, thirty to forty years.

Minnesota—Bounties for timber growing in plantations or one acre or more. Prescribed character and extent of forest management and the method of establishing compliance with the law.

Illinois—Bounties for planting and cultivating forest trees. Prescribes character of planting and cultivation and kind of proof necessary to show compliance with the law.

Connecticut classifies land into forest land and otherwise for taxation purposes. Fixes methods for determining the value of the land. Prescribes detailed methods of taxation and methods of obtaining yield tax from timber. Also prescribes varieties and character of land which may be devoted to forest growth.

Massachusetts—Very involved and technical. Land is classified, exempt from taxation under the general laws. Buildings subject to general taxation laws. Classified land subject to forest tax, exclusive of value of trees and timber. Forest-products tax levied on value of all wood, other products and other income is a fixed per cent. per annum which increases each year up to 6%, after which it is stationary. Certain exemptions for personal use of timber, detailed prescription for carrying out the provision of the law and detailed definition of terms, kind of reports, etc.

Vermont laws are almost identical with those of Connecticut.

CHECK LIST OF THE TREES IN KENTUCKY.

No trees are here included except such as are positively known to grow within the borders of the State. The only naturalized trees included are those which have extensively extended their range out of cultivation. Also only such species are included as attain a distinctly arborescent form within Kentucky. The technical nomenclature follows the American Code (1907).

Conifers (Evergreens).

White Pine.....	<i>Pinus strobus</i>
Pitch Pine.....	<i>Pinus rigida</i>
Scrub Pine.....	<i>Pinus virginiana</i>
Shortleaf Pine (Yellow Pine).....	<i>Pinus echinata</i>
Hemlock.....	<i>Tsuga canadensis</i>
Bald Cypress (Cypress)	<i>Taxodium distichum</i>
Red Cedar.....	<i>Juniperus virginiana</i>

Dicotyledons (Broad Leaf Trees).

Butternut (White Walnut).....	<i>Juglans cinerea</i>
Black Walnut (Walnut).....	<i>Juglans nigra</i>

Hickories—

a. Pecan	<i>Hicoria pecan</i>
b. Bitternut	<i>Hicoria cordiformis</i>
c. Shag-bark	<i>Hicoria ovata</i>
d. Shell-bark (King Nut)	<i>Hicoria laciniata</i>
e. Mockernut	<i>Hicoria alba</i>
f. Pignut	<i>Hicoria glabra</i>

Willows—

a. Black Willow	<i>Salix nigra</i>
b. Long-leaf (Sand-bar Willow).....	<i>Salix fluviatilis</i>
c. Glaucous (Pussy) Willow.....	<i>Salix discolor</i>
d. *Crack Willow.....	<i>Salix fragilis</i>

Poplars—

a. Aspen (Quacking Asp)	<i>Populus tremuloides</i>
b. Large Tooth Aspen	<i>Populus grandidentata</i>
c. Swamp (Downy) Cottonwood.....	<i>Populus heterophylla</i>
d. Cottonwood	<i>Populus deltoides</i>
e. *Lombardy Poplar.....	<i>Populus nigra italica</i>

*Naturalized.

Birches—

- a. River Birch *Betula nigra*
 b. Yellow Birch *Betula lutea*
 c. Sweet Birch *Betula lenta*

Hop Hornbeam (Ironwood) *Ostrya virginica*

Blue Beech (Hornbeam, Ironwood) *Carpinus caroliniana*

Beech *Fagus ferruginea*

Chestnuts—

- a. Chinquapin *Castanea pumila*
 b. Chestnut *Castanea dentata*

Oaks—

- a. White Oak *Quercus alba*
 b. Post Oak *Quercus stellata*
 c. Burr Oak *Quercus macrocarpa*
 d. Overcup Oak *Quercus lyrata*
 e. Chestnut Oak *Quercus prinus*
 f. Chinquapin Oak *Quercus muhlenbergii*
 g. Swamp White Oak *Quercus bicolor*
 h. Cow (Basket) Oak *Quercus michauxii*
 i. Red Oak *Quercus borealis*
 j. Texan Oak *Quercus texana*
 k. Scarlet Oak *Quercus coccinea*
 l. Black (Yellow) Oak *Quercus velutina*
 m. Spanish Oak *Quercus rubra*
 n. Pin Oak *Quercus palustris*
 o. Black Jack Oak *Quercus marilandica*
 p. Shingle (Laurel) Oak *Quercus imbricaria*
 q. Willow Oak *Quercus phellos*

Elms—

- a. American (White) Elm *Ulmus americana*
 b. Slippery Elm *Ulmus fulva*
 c. Rock (Cork) Elm *Ulmus thomasi*
 d. Winged Elm *Ulmus alata*
 e. Red Elm *Ulmus serotina*

Water Elm *Planera aquatica*

Hackberries—

- a. (Common) Hackberry *Celtis occidentalis*
 b. Mississippi Hackberry *Celtis mississippiensis*

Mulberries—

- a. Red Mulberry *Morus rubra*
 b. *White Mulberry *Morus alba*

Osage Orange (Bois d'Arc) *Toxylon pomiferum*

*Naturalized.

Magnolias—

- a. Cucumber Tree *Magnolia acuminata*
- b. Large Leaf Magnolia (Cucumber) *Magnolia macrophylla*
- c. Umbrella Tree *Magnolia tripetala*
- d. Fraser Magnolia *Magnolia fraseri*

Yellow Poplar (Tulip Tree) *Liriodendron tulipifera*

Papaw *Asimina triloba*

Red (Sweet) Gum *Liquidambar styraciflua*

Sycamore *Platanus occidentalis*

Crab Apples—

- Sweet (Common) Crab *Malus coronaria*
- Narrowleaf Crab *Malus angustifolia*

Service Berry (usually pronounced "Sarvice

Berry") *Amelanchier canadensis*

Haws—

- a. Red (Cock-spur) Haw *Crataegus crus-galli*
- b. Scarlet Haw *Crataegus coccinea*

Cherries and Plums—

- a. (Common) Wild Plum *Prunus americana*
- b. Chickasaw Plum *Prunus angustifolia*
- c. Wild Red Cherry (Bird Cherry) *Prunus pennsylvanica*
- d. (Wild) Black Cherry *Prunus serotina*
- e. Choke Cherry *Prunus virginiana*

Red Bud *Cercis canadensis*

Locusts—

- a. Honey Locust *Gleditsia triacanthos*
- b. Water Locust *Gleditsia aquatica*

Kentucky Coffee Tree *Gymnocladus dioica*

Yellow-wood *Cladastris lutea*

Black (Yellow) Locust *Robinia pseudacacia*

Hop Tree *Ptelea trifoliata*

*Allanhus (Chinese Sumac, Tree of Heaven) *Alanthus altissima*

*China Tree *Melia azedarach*

Sumacs—

- a. Staghorn Sumac *Rhus hirta*
- b. Smooth Sumac *Rhus glabra*
- c. Dwarf Sumac *Rhus copallina*

Holly *Ilex opaca*

Wahoo (Burning-bush) *Evonymus atropurpureus*

*Naturalized.

Maples—

- a. Mountain Maple *Acer spicatum*
- b. Sugar Maple (Sugar Tree) *Acer saccharum*
- c. Black Maple *Acer nigrum*
- d. Silver (Water Maple, Swamp Maple) *Acer saccharinum*
- e. Red Maple *Acer rubrum*
- f. Box elder (Ash-leaved Maple) *Acer negundo*

Buckeyes—

- a. Ohio Buckeye *Aesculus glabra*
- b. Yellow Buckeye *Aesculus octandra*
- c. Red Buckeye *Aesculus pavia*

Lindens—

- a. Basswood *Tilia americana*
- b. Downy Basswood *Tilia pubescens*
- c. White Basswood *Tilia heterophylla*

Hercules' Club (Angelica Tree) *Aralia spinosa*
 Flowering Dogwood (Dogwood) *Cornus florida*

Gums—

- a. Black Gum *Nyssa sylvatica*
- b. Swamp Black Gum (Tupelo) *Nyssa aquatica*

Sourwood *Oxydendron arboreum*

Persimmon *Diospyros virginiana*

Silverbell *Mohrondendron carolinum*

Ashes—

- a. Blue Ash *Frazinus quadrangulata*
- b. White Ash *Frazinus americana*
- c. Red Ash *Frazinus pennsylvanica*
- d. Green Ash *Frazinus lanceolata*
- e. Biltmore Ash *Frazinus biltmoreana*

Fringe Tree *Chionanthus virginica*

Catalpas—

- (Common) Catalpa *Catalpa catalpa*
- Hardy Catalpa *Catalpa speciosa*

NOTE: The State Forester is deeply indebted to Mr. Geo. B. Sudworth, Dendrologist of the Forest Service, U. S. Dept. of Agri., and to Prof. H. Garman, Entomologist and Botanist of the Ky. Agri. Exp. Station, for many suggestions and corrections in the compilation of this list.

GROWING TIMBER FOR MINING PURPOSES.

By

M. H. FORESTER,

Forester for the Consolidation Coal Company.

The planting of waste land by mining companies to timber trees which they expect to yield mine props and other products necessary to their operations, is not a new subject. Several companies even in Kentucky have anticipated their future requirements and started to grow timber for future use. Yet, the Consolidation Coal Company is undoubtedly the first to undertake commercial tree planting in the Eastern Kentucky mountains.

One-third of the total surface area in the Eastern Kentucky coal field has been cleared for agriculture in the past. The greater portion of this land has been worn out by successive corn crops and is now lying idle, sometimes used for pasturages, but generally going to waste and brier thickets. Natural reproduction is coming in but slowly, mostly locust, yellow poplar and sassafras, with occasional red oak seedlings. New farming land is being cleared each year, at what rate it is difficult to estimate. The national food situation stimulated the clearing of land considerably in 1917, and will undoubtedly do so to an increased extent in 1918.

Eliminating all bottom land and such fields which are fit for agriculture, as well as pasture land in the proximity of the camps, and areas reserved for operating and development purposes, there still remains a large acreage which yields the owners nothing and should be growing timber. In the case of the Consolidation Coal Company in Letcher, Pike and Knott Counties, this acreage amounts to about 4,500 acres, and the policy adopted by this company during the winter of 1916-1917 pursues the planting or seeding of these areas artificially and systematically to timber trees, valuable primarily in the mining of the coal underlying their property. An appropriation of \$2,500.00 was made for the work to be carried out during 1917.

The species selected were Black Locust and Red Oak, both of which are rapid growers, hardy and quite suitable for mining purposes. To avoid and control as much as possible the Locust Borer pest, the two species were mixed evenly; furthermore this should result in a stimulus of growth for both species. Anyone who is familiar with Eastern Kentucky hillsides and their farming possibilities, knows the difficulties to be encountered in establishing a forest plantation. (See Plate I.) Next to the steepness of the ground, the dense growth of briars, sassafras and other brush prevented rapid progress and low costs. Preliminary treatment in the form of clearing brush was necessary on about 40% of the total area, and cost 75c per acre for the entire area covered. (See Plate II.)

At the outset the common seed spot method was tried, with spots six feet apart in the row, and the latter spaced twelve feet to allow for an intermediate row of Locust plants. One year Locust seedlings and Red Oak acorns had been selected as the most advantageous for low cost, all which were obtained through the State Forester's office at Frankfort. The above named method was quickly abandoned as too expensive, and a new method tried and found efficient. Furrows were plowed twelve feet apart following the contour of the hill, either with a single horse or a light mule team (see Plate III); the seed dropped along in the furrow by one man and covered lightly by two others following him. Ten thousand lineal feet, or 1.4 acres with furrows six feet apart is a good average ten hour day's work for one team.

The Locust seedlings which were set out at practically the same time were first planted in prepared spots with the common mattock, and although later on planted in furrows, the spot method was found to be the most efficient and least expensive. (See Plate V.)

The following table shows the comparative cost of the methods tried. It shows conclusively that Locust plants in spots and Oak in furrows is the cheapest and most commendable form of establishing a plantation of this type and variety:

SUMMARY OF COSTS.

Method	Cost per acre	Basis acreage
Oak seed spots—Pure	\$18.28	10.7
Locust in spots—Pure	12.05	9.8
Locust and Oak mixed, sowed and planted in spots	15.16	19.6
Oak in furrows—Pure	12.18	28.8
Locust in furrows—Pure	13.49	7.0
Mixed Oak and Locust in furrows.....	12.83	14.0

This statement includes only labor and planting stock delivered at area. Basis 1,210 trees per acre.

Owing to the late spring season, it was necessary to hold over thirty acres of Locust planting till fall, as the plants had sprouted too much to run the risk of setting them out and consequent loss. Fence repairs, inspection of areas and current guarding for goldenrod are expenditures which will have to be considered in the first cost for 1917, and later on as annual expenditures, together with rental of the ground. This latter item will be negligible and taxation can be disregarded in this particular case.

The cost for the seventy-three acres completed is summarized in the following statement:

Area No.	Preliminary Treatment	Actual Planting	Stock	Pruning and Cultivating	Miscellaneous Inspection, Reports, etc.	Rental and Adjustment	Acres
1.	\$15.09	\$452.01	\$162.56	\$4.62	\$23.78	-----	34.4
2.	21.26	145.76	94.53	-----	16.76	\$193.08	30.0
3.	14.84	42.24	18.86	-----	7.67	-----	4.1
4.	.36	20.31	6.49	-----	6.93	-----	2.1
5.	2.66	12.35	10.17	-----	5.36	-----	1.7
Total	\$54.21	\$672.67	\$292.61	\$4.62	\$60.50	\$193.08	72.3
Grand Total \$1,277.69.							
Av. per A.	\$0.75	\$9.29	\$4.04	\$0.06	\$0.84	\$2.67	17.67

Results after the first two months show a germination of 60% of the Red Oak, and practically no loss on the Locust plants. Low fertility of the seed due to damage in storing, adverse weather conditions during the germinating period, and some loss through rodents, are factors to be considered in judging the results obtained. It is strongly advisable to sow the Red Oak in the fall, as the acorns do not keep well over winter even in cold storage. Rodents will have to be watched more carefully during fall and winter, but precautions can be taken to avoid such damage.

The net cost of \$15.00 per acre for establishing the plantation seems high, when standing timber averaging 6,000 F. B. M. can be purchased for \$25.00 per acre. Yet it must be borne in mind that the areas planted are readily accessible to the mining operations, and cost of utilization will be much less on the heavily

stocked areas than on the present wild areas. This initial cost of \$15.00 must furthermore be distributed over an indefinite number of successive crops. Once the stand is established, regeneration after each cutting is natural, by sprouting from the stumps.

The policy of this company will be to plant as much of the 4,500 acres available as is accessible to its mining territory in the shortest possible time. It is doubtful whether more than 200 acres can be successfully established each year. By bringing up the wild stands, which are now reproducing naturally, to average 800 mine props per acre, together with the yields from the plantations, the annual consumption of the mines would be taken care of by the annual growth, provided the development of coal property does not increase materially.

The silvicultural treatment of the natural stands is limited to the elimination of inferior species, and favoring the desirable species in the course of utilization and cuttings. Defective timber is removed in all operations, but lops and brush are left where they fall. After all the mine material has been cut from the laps there is little left but smaller branches, and these help to keep up the fertility of the ground, as well as protect it from erosion.

Fire protection of these cut over lands is the most important consideration and has been kept well in hand in the past. Sprouts and seedlings have come in well, excepting on some barren south slopes and small spots where either the original stand consisted of a group of large trees too old to sprout, or where there were natural blanks. These spots will be either planted up or seeded broadcast to Black Locust as soon as it is assured that natural reproduction has failed.

Mining interests rarely consider the importance of timber resources for future use. It is a subject which has never been brought home to them until too late to remedy except by a sudden heavy investment in timberland or a large advance in the price of the timber product itself. This can be avoided by accurate protection of land already timbered and regeneration of such land which is unfit for farming, and nothing more than waste.



Plate I.

View showing general character of land to be reforested. Furrows show method used for planting.



Mostly broom sage and scattered sassafras. No brushing necessary.



Plate II.
Heavy growth of briars. Views showing conditions encountered over the
areas reforested.



Plate III.
Furrows were plowed following the contour of the hill.



Plate IV.

Seed dropped by one man and covered slightly by two others following him.



Locusts set out in prepared spots with the common mattock.

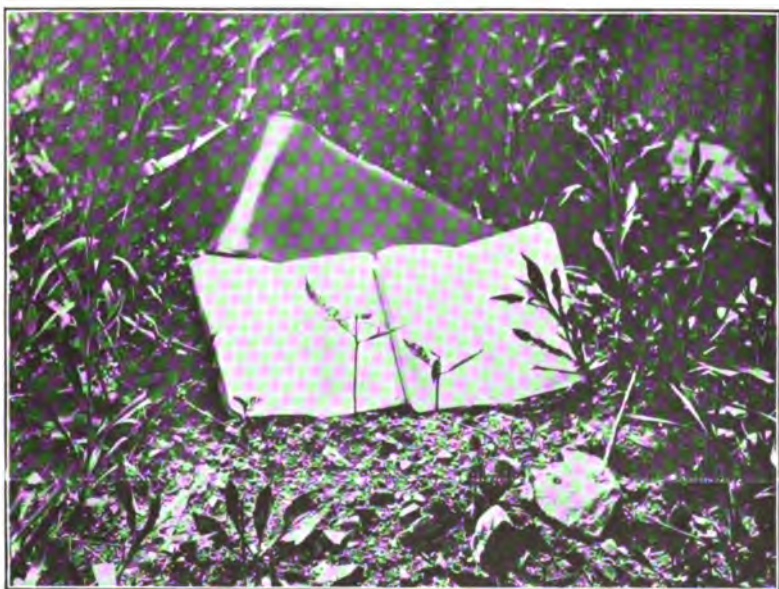


Plate V.

Red Oak seedlings. Seven inches high seven weeks after seeding.

